Don't Buy a Coil

UNTIL YOU HAVE SEEN

Edwards' No. 4 Portable X-Ray and High Frequency Coil

Points for Comparison

A *double* Tesla winding (not one only as commonly used.)

An 8 *inch* heavy flame (not 4½ or 5½ inch spark).

Absolutely no inverse in the tube.

RADIOGRAPHS of the extremities in a few *seconds* (not minutes).

RADIOGRAPHS of the *trunk or Pelvic* in 1 to 3 minutes(not 5 to 15 minutes).

MONO-POLOR (Tesla or Oudin) High Frequency Current.

BI-POLOR High Frequency Current.

D'ARSONVAL current for local or direct application and a *separate and very powerful D'Arsonval* for AUTO-CONDENSATION and AUTO-CONDUCTION.

THERMO-FARADIC Current.

ULTRA VIOLET LAMP Current.

SINUSOIDAL Current.

CAUTERY Current.

DIAGNOSTIC LAMP Current.

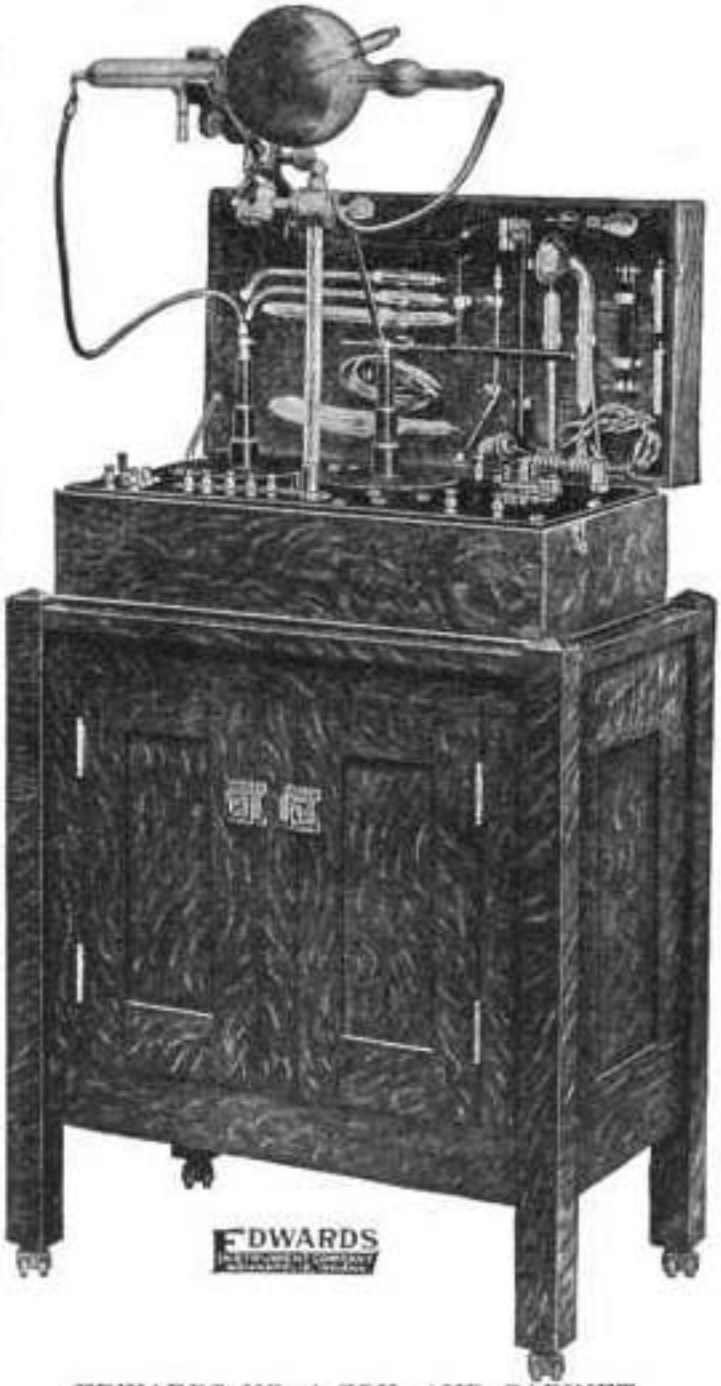
All currents under absolutely perfect control from zero to full strength.

Material and workmanship the very highest grade, each Coil thoroughly tested with heavy overload before leaving our factory. Fully guaranteed for *five years.*

Reference: Bank or Commercial Agencies and hundreds of satisfied customers.

Price: Coil complete with all attachments	$185.00
Cabinet	30.00
X-Ray tube, 6 in., extra heavy target	20.00
X-Ray Tube holder	3.00
Fluoroscope	12.50

Sold on payments or 5% discount for cash.



EDWARDS NO. 4 COIL AND CABINET

(The handle on the Coil case being at the back it does not have the appearance of being a portable outfit.)

Edwards Instrument Company

INCORPORATED

Manufacturers of

X-Ray and Electro-Therapeutic Apparatus

PHYSICIANS' FURNITURE

Office and Salesrooms 623-624 Newton Claypool Bldg., Phone: New 4703-R

INDIANAPOLIS

THE INDIANAPOLIS STAR
JANUARY 13, 1921 PG 8

DEMAND $10,000 DAMAGES FOR DEATH OF DENTIST

Because his son, Clatus L. Cope, a practicing dentist at Seymour, Ind., is alleged to have been electrocuted by the current of an X-ray machine while working on a patient in his chair, Thomas A. Cope, administrator of nis son's estate, yesterday filed suit in Superior court, Room 5, for $10,000 judgment against the Edwards X-Ray Corporation, 111 North New Jersey street; Juliett I. Herriott and W. Morton Herriott, partners in the firm of Mrs. W. M. Herriott & Son, 237 North Pennsylvania street.

The plaintiff alleges that his son contracted with the defendants for the installation of an X-ray device, which was set up in his office in Seymour on June 24, 1920. Proper insulation of the electrical machine and adequate instructions for operation of the device, it is alleged, were not attended to by the defendants. On July 16, 1920, while making X-ray photographs of a patient's teeth, Dr. Cope is alleged to have received a charge of electricity, which resulted in his death.

INCORPORATIONS.

Edward X-Ray Corporation, Indianapolis; capital, $250,000; electrical and mechanical apparatus; directors, Arminta M. Smith, Edwin L. Edwards, William A. Zumpfe, William H. Test, Murat W. Hopkins.

THE INDIANAPOLIS STAR
APRIL 29, 1942

Former X-Ray Firm Head Dies

Edwin L. Edwards Had Lived In City 35 Years.

Edwin L. Edwards, former president of the Edwards X-Ray Corporation and resident of Indianapolis for 35 years, died Tuesday night at the home of his daughter, Mrs. Perry Sylvester, 2860 Washington boulevard.

Mr. Edwards was born in Bloomington, Ill. He was president of the X-ray corporation until his retirement about 15 years ago. He was a member of the Masonic Blue Lodge at Bloomington, Ill., was a York Rite member and a Shriner.

Survivors are the widow, Mrs. Mary E. Edwards; the daughter, Mrs. Perry Sylvester; a granddaughter, Miss Patricia Sylvester, all of Indianapolis; two sisters, Mrs. Thomas W. Wyatt of Pasadena, Cal., and Mrs. Henry Page of Los Angeles, Cal., and a nephew, Donald E. Page of Indianapolis.

Funeral arrangements have not been completed.

E. L. EDWARDS.

X-RAY CABINET.

APPLICATION FILED JAN. 24, 1919.

1,419,241. Patented June 13, 1922.

Fig. 1.

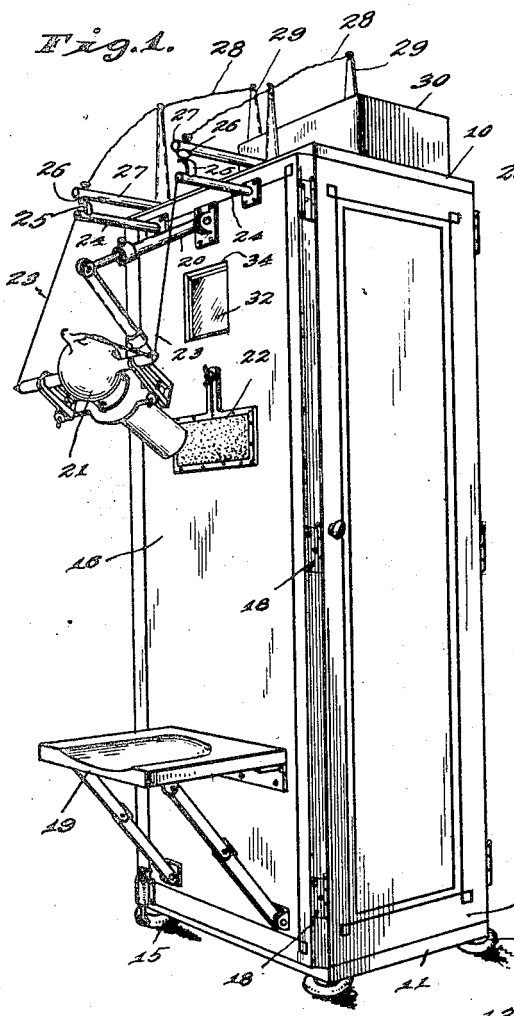


Fig. 2.

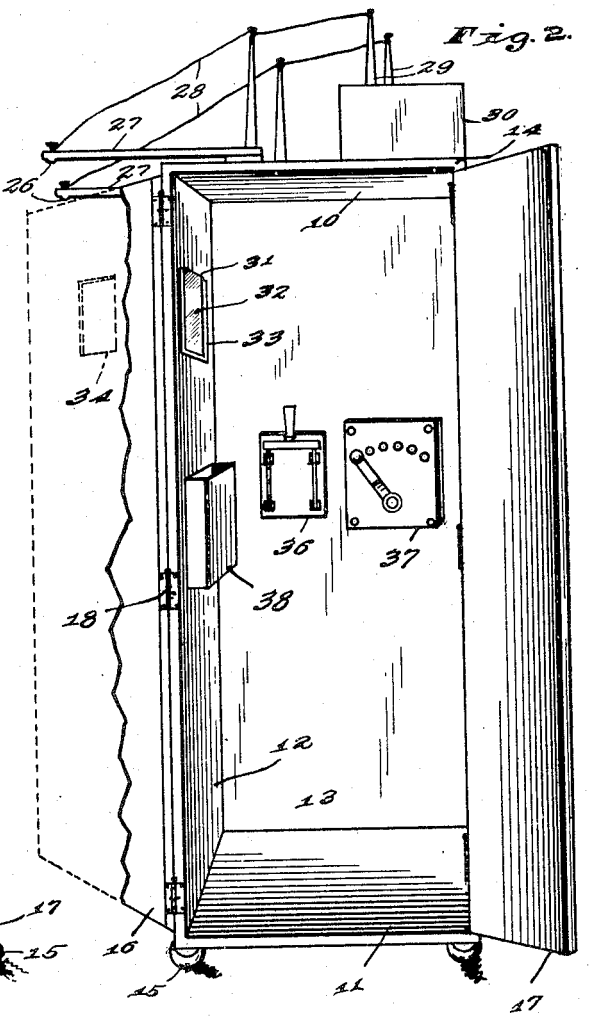
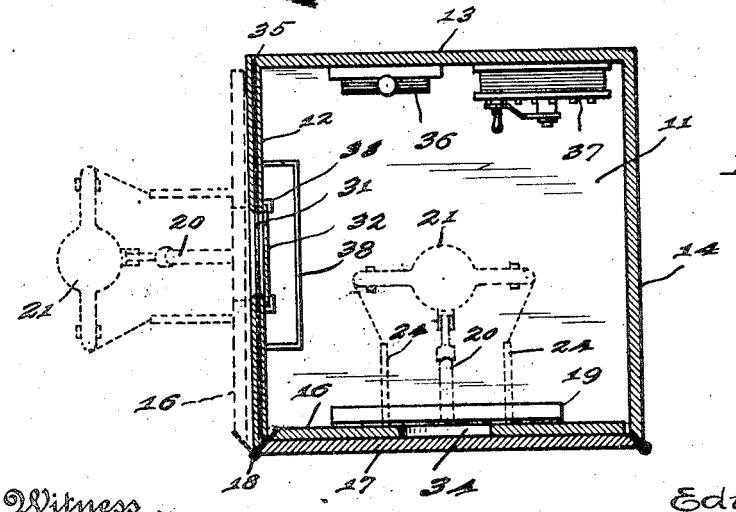


Fig. 3.



Witness
Frank A. Fahle

By

Inventor
Edwin L. Edwards,

Hood Sibley
Attorneys

UNITED STATES PATENT OFFICE.

EDWIN L. EDWARDS, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO EDWARDS X-RAY CORPORATION, OF INDIANAPOLIS, INDIANA, A CORPORATION OF INDIANA.

X-RAY CABINET.

1,419,241. Specification of Letters Patent. Patented June 13, 1922.

Application filed January 24, 1919. Serial No. 272,823.

To all whom it may concern:

Be it known that I, EDWIN L. EDWARDS, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful X-Ray Cabinet, of which the following is a specification.

It is the object of my invention to provide a self-contained X-ray cabinet, which can be used both as a protective enclosure for the operator and as a dark room for developing the negatives, and which swingingly supports the X-ray tube and a seat for the patient so that said tube and seat may be swung either into operative position outside the cabinet or into inoperative position within the cabinet.

The accompanying drawing illustrates my invention: Fig. 1 is a perspective view of an X-ray cabinet embodying my invention, with the parts in operative position; Fig. 2 is a somewhat similar perspective view, showing the interior of the cabinet, and with the tube-carrying door partly broken away; Fig. 3 is a horizontal section through the cabinet, with the working parts within it.

The cabinet has a top 10, a bottom 11, and three fixed sides 12, 13, and 14, conveniently supported on suitable feet 15, these three sides and the top and bottom and feet being relatively fixed and constituting a supporting stand. Conveniently the cabinet is of suitable height to receive a man standing up. At the free front edges of the sides 12 and 14 are hinged two doors 16 and 17. These two doors overlap with the door 17 outermost, as indicated in Fig. 3, so that the cabinet may be closed by such outer door 17 whether the inner door 16 is closed or open. In the latter case, at least, the closing of the cabinet by the outer door 17 is preferably light-tight. The inner door 16 may be swung either to the closed inoperative position shown in Fig. 3 or to the open, operative position shown in Fig. 1, in which latter position it lies against the outer face of the side wall 12; the hinges 18 on which said inner door 16 is mounted permit swinging of the door through 270° to accomplish this.

On what is its inner surface when it is closed the inner door 16 carries near the bottom a patient's seat 19, which is preferably a suitable form of folding seat as illustrated, and near the top an adjustable support 20 for an X-ray tube 21; so that the seat and tube are on what is the outer surface of the door 16 when such door is fully open and lies against the wall 12, but are folded into the space within the cabinet when such door is closed. The same face of the door 16 may be provided with an adjustable head-rest 22, for the patient's head. By manipulating the support 20 in the usual way, the rays from the tube 21 may be directed as desired. The terminals of the tube 21 are connected by suitable conductors 23 to the outer ends of insulating posts 24 fixed to the same face of the door 16; and these posts 24 are provided with spring fingers 25 connected to the conductors 23 and arranged to engage corresponding spring fingers 26 on forwardly projecting insulating posts 27 carried by the cabinet top 10. The spring fingers 26 are connected by suitable conductors 28 to the secondary terminals 29 of a suitable high-tension transformer 30, mounted on the cabinet 10. Thus the connections from the X-ray tube 21 to the transformer 30 are made and broken by the swinging of the inner door 16.

At about the height of a man's eyes, the wall 12 is provided with a window opening 31, which may receive any desired glass 32, such as lead glass when the X-ray apparatus is in use, a ruby glass when the cabinet is used for developing purposes, and an opalite glass to examine negatives. If desired, the ruby glass may be removably superposed over the lead glass, so that it may be put into or out of position at will; or the window may be provided with glass-receiving slideways 33 in which either a ruby glass or a lead glass may be placed as desired. The door 16 is provided with an opening 34 which registers with the window 31 when such door is swung back against the wall 12. In order to protect the operator, a screen formed by a layer of lead 35 or other material opaque to X-rays is mounted between the tube and the operator, as in the side wall 12 as shown in Fig. 3, and if desired in any of the other side walls or in the doors 16 and 17, though ordinarily such a protective layer in the side wall 12 is sufficient.

Mounted within the cabinet are the electrical controlling devices, such as a switch 36 and a rheostat 37; and also mounted within the cabinet is a developing tank 38. The

developing tank is preferably on the wall 12 below the window 31, and the electrical controlling devices are preferably on the wall 13, as is clear from Figs. 2 and 3.

When the cabinet is not in use, the doors 16 and 17 are both closed, and the X-ray tube 21 and its support and the patient's seat 19 are folded within the cabinet. When the cabinet is in use, the inner door 16 is swung open so that it lies against the side wall 12, thus connecting the X-ray tube 21 to the transformer 30 by the interengagement of the spring fingers 25 and 26. The patient is placed in proper position on the seat 19, the support 20 is adjusted so that the rays from the tube 21 will be directed in the desired direction, and the plate or film to be exposed is put in position. Then the operator enters the cabinet, preferably closing the door 17 behind him, and manipulates the controlling devices, such as the switch 36 and rheostat 37, to produce the desired exposure. Then the operator comes out and gets the exposed film or plate; and if he wishes may immediately return into the cabinet and develop such film or plate in the developing tank 38, the door 17 being closed and the ruby glass being in position over the window 31 during such developing.

I claim as my invention:

1. An X-ray cabinet, comprising a cabinet with a swinging member, an X-ray tube mounted on said swinging member for all positions of the latter so that by the swinging of said member said tube may be swung into or out of said cabinet, and controlling devices for said tube mounted within said cabinet.

2. An X-ray cabinet, comprising a cabinet with a swinging member, and an X-ray tube mounted on said swinging member for all positions of the latter so that by the swinging of said member said tube may be swung into or out of said cabinet.

3. An X-ray cabinet, comprising a cabinet provided with a swinging door, a patient's seat and a support for an X-ray tube mounted on that face of the door which is the inner face when the door is closed, and controlling devices for said X-ray tube mounted within said cabinet.

4. An X-ray cabinet, comprising a cabinet provided with a swinging door, and a patient's seat and a support for an X-ray tube mounted on that face of the door which is the inner face when the door is closed.

5. An X-ray cabinet, comprising a cabinet provided with a swinging door, a support for an X-ray tube permanently mounted on that face of the door which is the inner face when the door is closed, and controlling devices for said X-ray tube mounted within said cabinet.

6. An X-ray cabinet, comprising a cabinet provided with a swinging door, and a support for an X-ray tube permanently mounted on that face of the door which is the inner face when the door is closed.

7. An X-ray cabinet, comprising a stand, a patient's seat foldably mounted on one side of said stand at an intermediate point in the height of said side, and a support for an X-ray tube also mounted on said stand to extend over the head of a patient sitting on said seat, said support being adjustable to make the X-ray tube co-operate with said patient.

8. An X-ray cabinet, comprising a cabinet having a swinging door, an X-ray tube mounted on said door, high-tension supply conductors, and means controlled by the swinging of the door for connecting said X-ray tube to said high-tension supply conductors.

9. An X-ray cabinet, comprising a cabinet having a swinging member, an X-ray tube mounted on said swinging member for all positions of the latter so that it may be swung either into the cabinet or outside of the cabinet, a transformer mounted on the top of the cabinet, and connections from said transformer to said X-ray tube.

10. An X-ray cabinet, comprising a cabinet having a swinging member, an X-ray tube mounted on said swinging member so that it may be swung either into the cabinet or outside of the cabinet, a transformer mounted on the top of the cabinet, and means controlled by the movement of said swinging member for connecting said X-ray tube to and disconnecting it from said transformer.

11. An X-ray cabinet, comprising a cabinet having a swinging member, an X-ray tube mounted on said swinging member for all positions of the latter so that it may be swung either into the cabinet or outside of the cabinet, a transformer mounted on the top of the cabinet, and connections from said transformer to said X-ray tube, and controlling devices for said transformer located within said cabinet.

12. An X-ray cabinet, comprising a cabinet having two doors which overlap when both are closed, and a support for an X-ray tube mounted on that face of the inner door which is the inner face when such door is closed, said outer door having a light-tight joint with said cabinet when said inner door is open and said outer door is closed.

13. An X-ray cabinet, comprising a cabinet having an openable side formed by two overlapping doors hinged at the opposite edges of said openable side and overlapping when both doors are closed, a support for an X-ray tube mounted on that face of the inner door which is the inner face when such door is closed, said inner door being openable by swinging so that what is its outer face when it is closed will when it is open

lie against an outer face of a fixed wall of said cabinet.

14. An X-ray cabinet, comprising a cabinet having at one side, a hinged door for closing said side, a support for an X-ray tube mounted on that face of said door which is the inner face when such door is closed, said door being openable by swinging so that what is its outer face when it is closed will when it is open lie against an outer face of a fixed wall of said cabinet.

15. An X-ray cabinet, comprising a cabinet with a swinging member, an X-ray tube mounted on said swinging member so that by the swinging of said member said tube may be swung into or out of said cabinet, controlling devices for said tube mounted within said cabinet, and a screen opaque to X-rays mounted between the X-ray tube and the position of the operator when he operates said controlling devices.

16. An X-ray cabinet, comprising a cabinet with a swinging member, an X-ray tube mounted on said swinging member so that by the swinging of said member said tube may be swung into or out of said cabinet, tube-controlling devices associated with said cabinet, and a screen opaque to X-rays mounted between the X-ray tube and the position of the operator when he operates said controlling devices.

17. An X-ray cabinet, comprising a stand, a patient's seat mounted on said stand at an intermediate point in the height thereof, and a support for an X-ray tube also mounted on said stand to extend over the head of a patient sitting on said seat, said support being adjustable to make the X-ray tube cooperate with said patient.

18. An X-ray cabinet, comprising a stand, a patient's seat mounted on said stand at an intermediate point in the height thereof, a support for an X-ray tube also mounted on said stand to extend over the head of a patient sitting on said seat, said support being adjustable to make the X-ray tube cooperate with said patient, and controlling devices for said X-ray tube carried by said stand.

In witness whereof, I have hereunto set my hand at Indianapolis, Indiana, this 20th day of January, A. D. one thousand nine hundred and nineteen.

EDWIN L. EDWARDS.

March 18, 1924. 1,487,152

E. L. EDWARDS

AUTOMATIC ELECTRICAL CIRCUIT CONTROLLER

Filed April 15, 1920

Fig. 1.

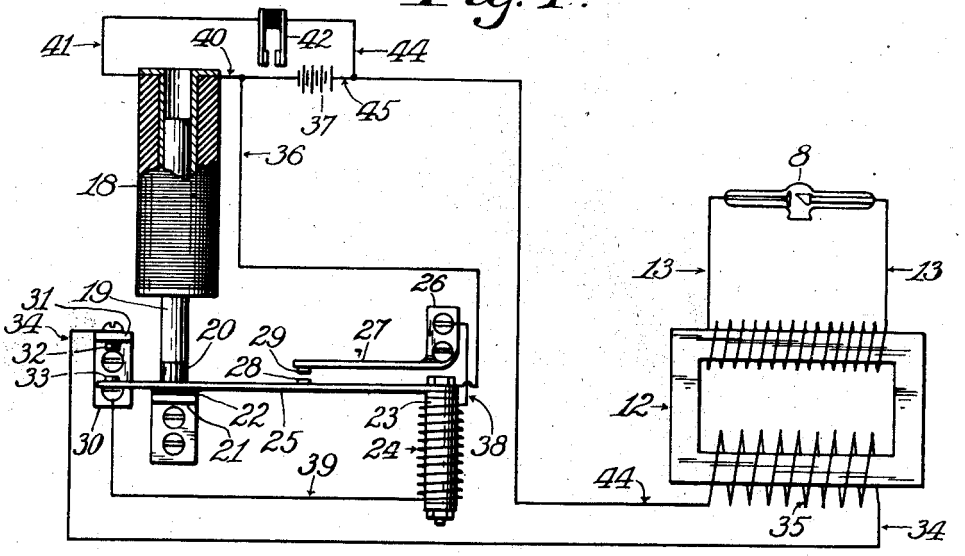


Fig. 2.

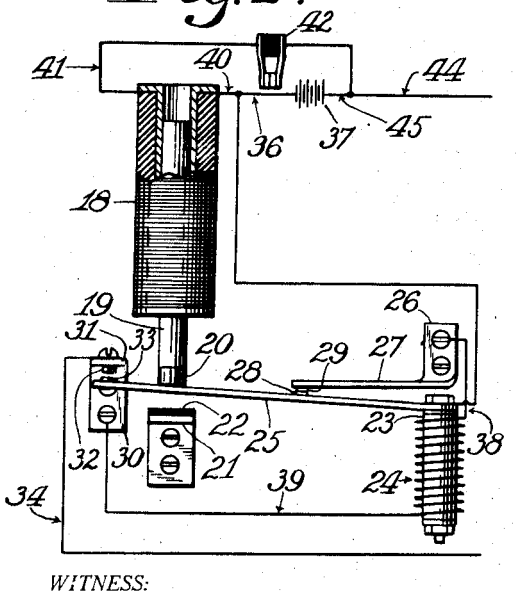
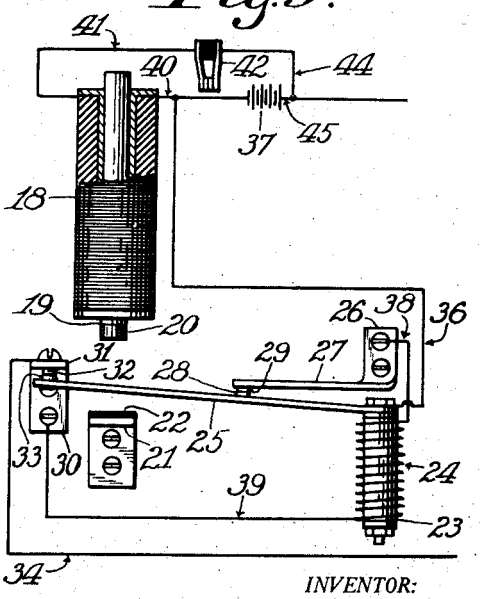


Fig. 3.



WITNESS:

Ed J. Clark.

F. M. Roder

INVENTOR:

Edwin L. Edwards,

BY

E. P. Silvius,

ATTORNEY.

Patented Mar. 18, 1924. 1,487,152

UNITED STATES PATENT OFFICE.

EDWIN L. EDWARDS, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO EDWARDS X-RAY CORPORATION, OF INDIANAPOLIS, INDIANA, A CORPORATION OF INDIANA.

AUTOMATIC ELECTRICAL CIRCUIT CONTROLLER.

Application filed April 15, 1920. Serial No. 374,191.

To all whom it may concern:

Be it known that I, EDWIN L. EDWARDS, a citizen of the United States, residing at Indianapolis, in the county of Marion, and State of Indiana, have invented a new and useful Automatic Electrical Circuit Controller, of which the following is a specification, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon.

This invention relates to the automatic control of electrical currents, more particularly to the control of an electrical current to transformers, and the invention relates especially to the automatic switching of an electrical current through a resistance to a transformer and subsequently conducting the electrical current directly to the transformer.

An object of the invention is to eliminate faulty electrical connections and consequent trouble arising from unreliable or inefficient manual manipulation or operation of switching or controlling appliances, more particularly in the operation of X-ray apparatus.

Another object is to enable operators of X-ray apparatus to reliably obtain the maximum efficiency in the operation of the apparatus, and without liability to derangement or injury to the apparatus resulting from inaccurate or faulty manual manipulation of controlling devices.

A further object is to provide an automatic electrical circuit controller to control an alternating electrical current to the greatest advantage through a transformer and an X-ray tube, the alternating electrical current being graphically a more or less perfect sine wave, the voltage rising from zero at the start to maximum as the peak of each half-cycle is reached; and consequently, when alternating current is turned directly into a transformer, especially high voltage transformers of some types, such as those used for X-ray work, the transformer is subjected to an excessive amount of stress in case the peak of the wave or highest point of voltage of supply current be in action at the moment the controlling switch is closed; and, the switch hitherto having been manually and haphazardly operated, if by chance the switch is closed at the moment the voltage is at the wave peak or highest voltage point the sudden surge of maximum voltage which may result, is to be prevented by the present invention from passing into the transformer; an aim being to provide a system including a resistance and means to automatically, when a controlling switch is closed, to conduct an electrical current first through the resistance momentarily to a transformer and subsequently to conduct the current directly to the transformer, and without requiring the objectionable method of manually manipulating any controlling device after closing the switch, an objection to such manual control being that the operator may neglect to properly operate such device and consequently the transformer may not get the full required voltage with the result that its power may be proportionately reduced, another result being that the resistance which may be used may be burned out with consequent loss of time, trouble and expense.

With the above-mentioned and other objects in view, the invention consists in a system and means for momentarily reducing the voltage of an electrical current in its passage to a transformer and means to automatically act to control the electrical current; and, the invention consists also further in the novel features and in the parts and combinations and arrangement of parts, as hereinafter particularly described and further defined in the appended claims.

Referring to the drawings,—Figure 1 is an elevation of the preferred circuit controller and diagram of an electrical system, the controller being represented as inactive; Fig. 2 is a curtailed view similar to the preceding figure but showing the controller as in its first stage of action; Fig. 3 is a view similar to the preceding figure but with the controller represented as in its final stage of activity.

In the various figures of the drawings similar reference characters indicate corresponding elements or features of construction herein referred to in detail.

In order to clearly illustrate the invention, its mode of operation and one of the useful and advantageous applications thereof, so much of an X-ray apparatus as may be associated with the invention is shown in the drawings and comprises an X-ray tube 8 and a transformer 12, a high tension circuit 13 leading from the transformer to the X-ray tube.

Preferably the electrical circuit controller structure is produced as a unit on a suitable base, a solenoid 18 is suitably arranged and its armature 19 has an insulating end 20 as preferably constructed, the armature preferably being cylindrical and vertically arranged; and below the solenoid a stop bracket 21 is suitably supported and if not insulated is provided on its top with an insulation 22 arranged opposite to the insulating end of the solenoid armature. A suitable electrical resistance device is provided and preferably has a core 23 vertically arranged at a distance from the stop bracket, an electrical resistance coil 24 being properly arranged on the core. A long elastic electrical switch arm 25 is suitably supported at one end and extends across the stop bracket but at a distance therefrom, the elasticity of the arm permitting it to be forced down by the solenoid armature to the stop bracket. A base 26 is suitably supported and has an elastic electrical switch finger 27 thereon that extends opposite to the arm 25 so that electrical connection may be made between the finger and the arm, the arm and the finger preferably having contact points 28 and 29 respectively, which are not in contact when the arm 25 is resting on the stop bracket, but are in contact when the arm moves a suitable distance away from the bracket. An electrically conducting plate 30 is suitably supported in proximity to the stop bracket and it has a lateral projection 31 thereon which is provided with a contact point 32 which preferably is adjustable in the projection and is engaged by the switch arm 25, or a contact point 33 on the arm when the solenoid armature releases the switch arm, the latter being free to move at a short distance from the conducting connector plate 30. A circuit wire 34 is connected with the contact point 32 and with one end of the primary coil 35 of the transformer. A feed circuit wire 36 is connected with a suitable generator or source of electrical energy 37 and is connected also with the switch arm 25. A circuit wire 38 is connected with one end of the resistance coil 24 and also with the base 26 of the switch finger 27. A circuit wire 39 is connected with the opposite end of the resistance coil and also with the connector plate. A branch wire 40 is connected with the feed wire 36 and also with one end of the winding of the solenoid 18, another wire 41 being suitably connected with the solenoid winding and with one side of a suitable switch 42 symbolically illustrated in the drawings, in practice the switch being usually outside of the cabinet of the apparatus. A return wire 44 is connected with the opposite end of the primary coil 35 of the transformer and is connected with the opposite side of the switch and also with the source of current supply by means of a branch 45. The feed wire 36 and the return wire branch 45 in practice are arranged in a cable so as to extend outside of the cabinet of the apparatus.

In practical use, the circuit switch 42 being open, as shown in Fig. 1, the solenoid armature is lowered and rests upon the switch arm 25 which is supported on the stop bracket 21, the arm 25 being separated from the switch finger 27 and also from the contact point 32. Upon closing the circuit switch 42, as in Fig. 2, the current energizes the solenoid to cause the armature to be drawn in, permitting the switch arm 25 to spring up slightly until contact is made with the finger 27, when the current passes from the arm to and through the finger 27, through the wire 38 and thence through the resistance coil 24, following the wire 39 and through the contact plate 30, and thence through the wire 34 to the primary coil of the transformer, momentarily reducing the voltage of the current while the solenoid armature rises further and permits the arm 25, without breaking connection with the finger 27, to travel further and make connection with the contact point 32; and thus the electrical current instead of continuing to pass through the resistance coil follows the line of least resistance through the switch arm 25 and the contact point 32 to the transformer through the wire 34.

Having thus described the invention, what is claimed as new is—

1. An automatic electrical circuit controller including a resistance coil, an elastic supported switch finger in connection with the resistance coil, a supported connector having a contact-point, a circuit connecting the resistance coil with the connector, a circuit in connection with the contact-point, a supported switch arm to be elastically pressed to the switch finger and farther to the contact-point, a feed-wire leading to the switch arm, and a solenoid having an armature arranged to control the switch arm.

2. In an automatic electrical circuit controller, the combination of a vertical resistance core, an electrical resistance coil on the core, an elastic switch finger supported above the resistance core and electrically connected with one end of the resistance coil, an elastic switch arm supported by the resistance core and extending under the switch finger, said arm being elastically pressed to said finger and extending beyond the finger, a supported stop below the switch arm, a feed-wire connected with the supported portion of the switch arm, a connector plate supported adjacent to the unsupported end of the switch arm and having a contact point to be engaged by the switch arm when the arm is in contact with said finger, a circuit wire connected with the opposite end of the resistance coil and with the connector

plate, a feed-wire connected with said contact point, and a solenoid supported above said stop and said switch arm and having an armature vertically movable to hold said switch arm to said stop and away from said contact point and said switch finger.

3. In an automatic electrical circuit controller, the combination with two supported contact devices, of a resistance coil constantly connected in circuit with the contact devices, a circuit wire connected with one of the contact devices and thereby with the resistance coil, a feed wire to be connected with the remaining one of the contact devices, a switch element movably supported and adapted to electrically connect the feed-wire with the two contact devices successively, and an electro-magnet connected with the feed-wire and having an armature arranged to control the switch element.

In testimony whereof, I affix my signature in presence of two witnesses.

EDWIN L. EDWARDS.

Witnesses:
E. T. SILVIUS,
F. M. ROEDER.

April 8, 1924. 1,489,883

E. L. EDWARDS ET AL

COIN CONTROLLED LOCK

Filed June 22, 1921 2 Sheets-Sheet 1

Fig. 1.

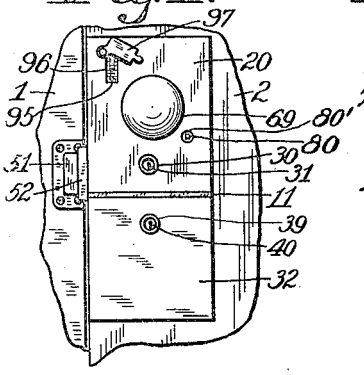


Fig. 2.

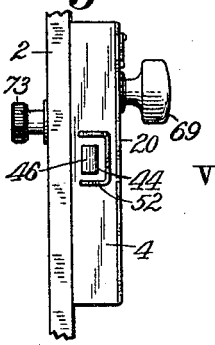


Fig. 3.

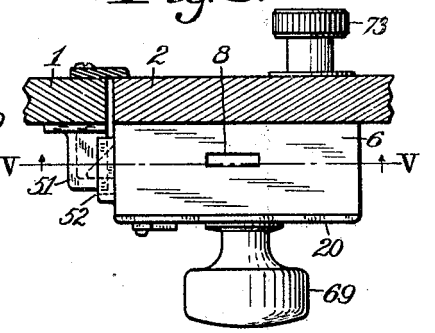


Fig. 4.

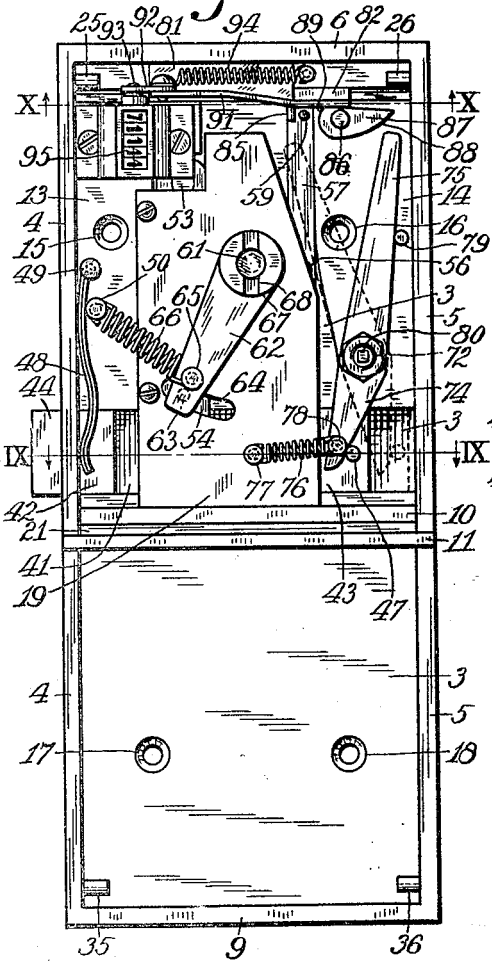
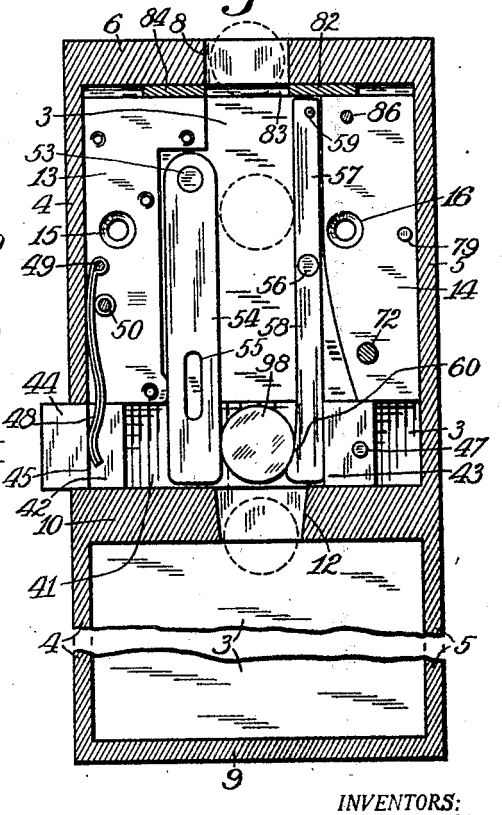


Fig. 5.



INVENTORS:
E. L. Edwards, F. A. Farwell,
F. O. Wiley.
By E. T. Silvius,
ATTORNEY.

April 8, 1924. 1,489,883

E. L. EDWARDS ET AL

COIN CONTROLLED LOCK

Filed June 22, 1921 2 Sheets-Sheet 2

Fig. 6.

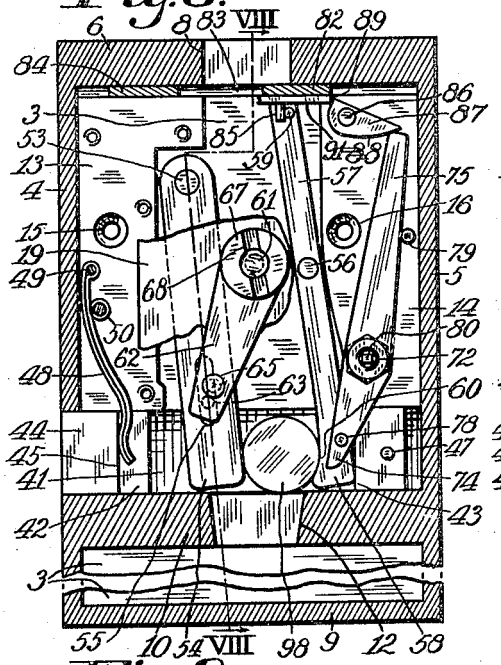


Fig. 7.

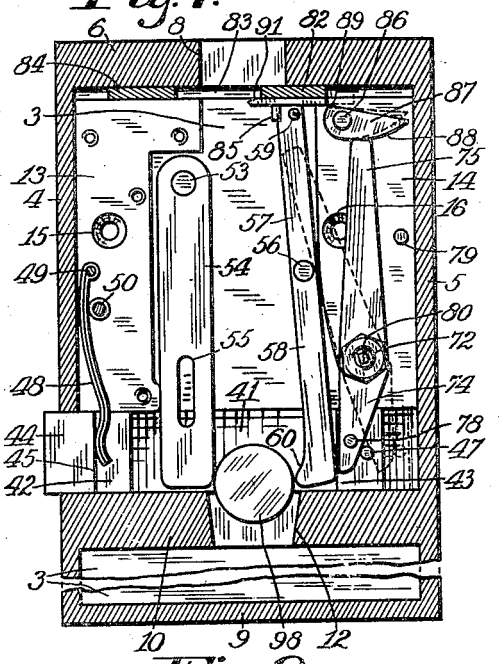


Fig. 8.

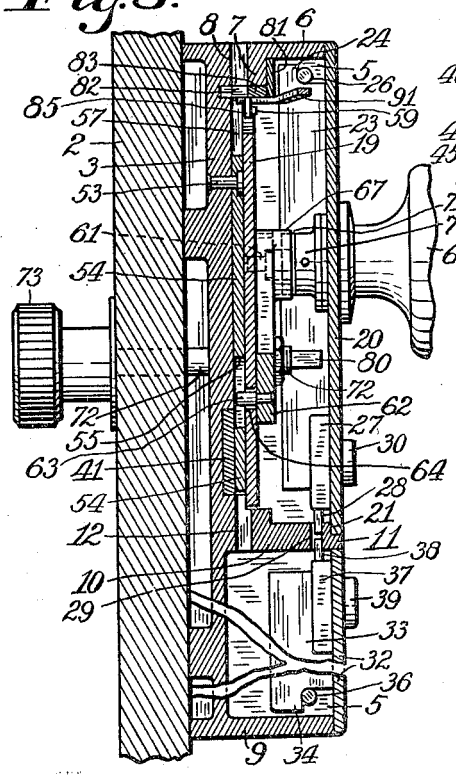


Fig. 9.

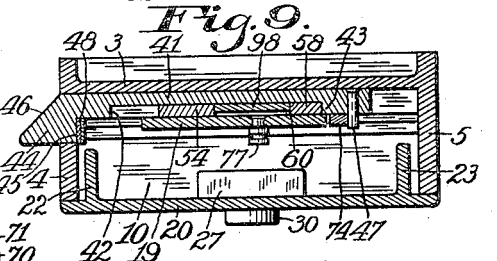
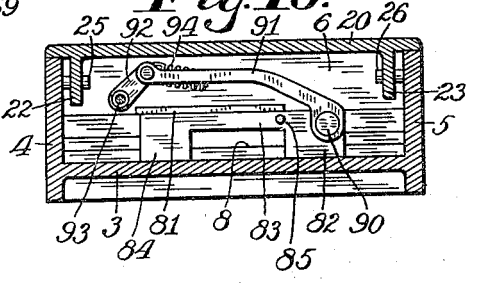


Fig. 10.



INVENTORS:
E. L. Edwards, F. A. Farwell,
F. O. Wikey,
By E. D. Silvius,
ATTORNEY.

Patented Apr. 8, 1924. 1,489,883

UNITED STATES PATENT OFFICE.

EDWIN L. EDWARDS, FRANK A. FARWELL, AND FRANK O. WILEY, OF INDIANAPOLIS, INDIANA, ASSIGNORS TO UNIVERSAL SERVICE CORPORATION, OF INDIANAPOLIS, INDIANA, A CORPORATION OF INDIANA.

COIN-CONTROLLED LOCK.

Application filed June 22, 1921. Serial No. 479,495.

To all whom it may concern:

Be it known that we, EDWIN L. EDWARDS, FRANK A. FARWELL, and FRANK O. WILEY, citizens of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Coin-Controlled Lock, of which the following is a specification, reference being had to the accompanying drawings, and to the figures of reference marked thereon.

This invention relates to a lock of the type that is used on doors of toilet rooms and on doors of rooms or apartments to which entrance may be gained by the deposit of a fee, the invention having reference more particularly to a lock that is designed to be operated to unlock a door by means of a coin inserted in the lock.

An object of the invention is to provide a coin-controlled lock which shall be so constructed as to not be costly, but shall be simple and reliable and not be liable to become deranged nor troublesome in use.

Another object is to provide an improved coin-controlled lock and coin box combined which shall be of such construction as to permit compactness of mechanism and provide for large coin capacity, and which shall be of such structure as to be durable and economical in use.

With the above-mentioned and other objects in view, the invention consists in a coin-controlled lock having operative mechanism of improved structure permitting coins to pass progressively by the force of gravity through the lock-controlled means and into the coin box; and, the invention consists also further in the novel parts and in the combinations and arrangements of parts as hereinafter particularly described and further pointed out in the accompanying claims.

Referring to the drawings, Figure 1 is a front elevation of the improved lock in connection with a door and door frame of which fragments are shown; Fig. 2 is a fragmentary edge view of the door and the lock applied thereto; Fig. 3 is a top plan of the improved lock and a keeper with which the lock co-operates, on an enlarged scale, as applied to a door and door frame of which a fragmentary horizontal section is shown; Fig. 4 is a front elevation of the improved lock minus its covers, on an enlarged scale; Fig. 5 is a fragmentary vertical section of the lock approximately on the line V—V in Fig. 3; Fig. 6 is a view similar to Fig. 5, but with operative parts in different positions; Fig. 7 is a view similar to Figs. 5 and 6 except that the operative parts are shown in different positions; Fig. 8 is a section approximately on the line VIII—VIII in Fig. 6 on an enlarged scale, as the lock is applied to a door; Fig. 9 is a horizontal section approximately on the line IX—IX in Fig 4; and, Fig. 10 is a horizontal section approximately on the line X—X in Fig. 4.

Similar reference characters in the different figures of the drawings indicate corresponding or like elements or features of construction herein referred to in detail.

In the drawings the numeral 1 indicates a door frame and 2 indicates a door provided with the improved lock which as preferably constructed comprises a back plate 3, side walls 4 and 5, a top 6 having a projecting guide portion 7 on its inner side in which is a coin slot 8, a bottom 9 connected to the side walls and the back plate, and a partition 10, constituting the principal portion of a casing having an upper chamber for the lock mechanism and a lower chamber to hold the spent coins. The partition 10 preferably has a guide rib 11 projecting beyond the plane of the front of the side walls, and the partition has a slot 12 therein to permit the coins to pass into the coin box, the slot preferably being broader at its top than at its lower end. The back plate 3 has a relatively thick portion 13 adjacent to the side wall 4 and a thick portion 14 adjacent to the side wall 5. The back plate has screw holes 15 and 16 in the thicker portions respectively to receive screws whereby to secure the casing to the door, the lower portion of the back plate having also screw holes 17 and 18 to receive securing screws. A guide plate 19 is secured to the front of the portion 13 of the back plate and extends down to the partition 10 and also over nearly to the thicker portions 14 of the back plate.

The upper chamber of the casing is provided with a front plate 20, the lower end of the plate preferably being arranged in connection with a stop shoulder 21 corresponding to the front of the partition 10.

The inner side of the front plate preferably has ribs 22 and 23 thereon to stiffen the plate and also guide it to position between the side walls of the casing, and each rib has a projection 24 on its end that is normally adjacent to the top 6, the projections normally extending behind suitably supported keepers 25 and 26 whereby to secretly lock the upper portion of the front plate securely in place. The lower portion of the front plate is provided on its inner side with a lock 27 from which a lock bolt 28 is projected into a slot 29 with which the partition 10 is provided. The lock has a guide barrel 30 thereon in which a key cylinder 31 is arranged. The coin box is provided with a front plate 32 which also has ribs 33 on its inner side that are provided each with a projection 34 normally arranged adjacent to the bottom 9, the projections engaging keepers 35 and 36 suitably supported adjacent to the bottom. The inner side of the upper portion of the front plate 32 is provided with a lock 37 from which a lock bolt 38 is projected into the slot 29, and the lock is provided with a guide barrel 39 in which a key cylinder 40 is arranged.

A lock bolt is provided which has a body portion 41 and is horizontally arranged upon or above the partition 10, the back plate 3 being recessed to receive the bolt. The forward portion of the lock bolt has a relatively thick portion 42 and the rearward or opposite end has a relatively thick abutment portion 43 on the front of the body portion, and the bolt has a thicker head portion 44 which provides a shoulder 45 at the rearward end thereof, the head portion being movably guided in the side wall 4 of the casing and normally projecting therefrom, and it has a beveled or inclined back 46 to engage the front of a keeper. The lock bolt is provided with a stud 47 which projects from the front of the abutment portion 43. A plate spring 48 is arranged adjacent to the inner side of the wall 4 and is connected to a fixed stud 49 from which it extends to and beyond a tension stud 50 to the shoulder 45 and so that it automatically projects the lock bolt into a keeper 51 secured to the outer side of the door frame 1. Preferably the wall 4 has a guard 52 thereon that partially covers the front and upper and lower portions of the keeper to prevent the insertion of any instrument between the lock casing and the keeper in an effort to retract the lock bolt.

The upper portion of the back plate 3 has a pivot 53 thereon to which a controlling bar 54 is connected, the bar extending downward and adjacent to the front of the body portion 41 of the lock bolt, and the bar has a vertical slot 55 therein. The back plate 3 is provided also with another pivot 56 at a suitable distance from the bar 54, the pivot 56 being lower than the pivot 53, and it supports a controlling lever between its ends so as to provide an upper arm 57 and a lower arm 58, the upper arm having a stud 59 thereon adjacent to its upper end. The controlling lever and the controlling bar are arranged between the thicker portions 13 and 14 of the back plate and a suitable distance apart to receive a coin of certain denomination between them, and the lower arm 58 preferably has a concavity 60 in the edge thereof that is presented towards the bar 54, to receive a portion of the coin and temporarily hold the coin in contact with the bar 54. The arm 58 extends against the abutment portion 43 of the lock bolt and adjacent to the thinner portion 41, the concavity preferably being arranged so as to retain the coin opposite to the portion 41. The lower end of the arm 58 preferably is relatively broad so that a portion thereof projects laterally to form the lower portion of the concavity. It will be seen that the back plate 3, the guide plate 19 which constitutes a frame member, and the bar 54 and the opposite lever constitute a coin chute.

The plate 19 is provided with a pivot 61 to which a lever or operating arm 62 is connected, the arm 62 having a wrist pin 63 thereon that extends through a slot 64 in the plate 19 and extends also into the slot 55. The arm 62 has a lug 65 thereon to which a coil spring 66 is connected, the spring being suitably anchored preferably to the stud 50, to yieldingly hold the bar 54 against the adjacent lower portion of the back plate portion 13. The arm 62 has a boss 67 on its front and the boss has a key slot 68 in its front portion. A knob 69 has a suitable spindle member 70 that is rotatively arranged in the front plate 20 in alinement with the pivot 61 and so that the knob shall be carried by the front plate and prevented from being removed when the front plate 20 is secured to the remaining portion of the lock casing. The knob spindle has a key 71 on its inner end that extends into the slot 68 which enables the knob to move the lever arm 62 and the arm to move the controlling bar 54.

For the purpose of enabling the door to be opened by a person within a room or apartment a spindle 72 is arranged so as to extend through the door 2 and through the back plate of the lock, and it has a knob 73 fastened thereto at the inner side of the door. A lever is secured between its ends to the spindle 72 so as to have a downward extending arm 74 and an upward extending arm 75. The arm 74 extends partially across the front of the abutment portion 43 of the lock bolt and between the stud 47 and the adjacent edge of the frame member 19,

and preferably the arm is yieldingly drawn towards the frame member by means of a coil spring 76 anchored to a stud 77 secured to the member 19, the spring being connected to a stud 78 carried by the arm 74, but in some cases the spring may be omitted. The arm 75 is suitably stopped in its movement towards the side 5 of the casing, either directly by the side or by means of a stud 79 as shown, to limit the movement of the lock bolt when projected by the spring 48. The inner end of the spindle 72 which is within the casing has a squared or peculiarly shaped portion 80 adapted to receive a special key to be inserted through a key hole 80′ in the front plate 20, so that in special cases the door may be unlocked from the outside without the use of a coin.

The projecting portion 7 of the top 6 has a downwardly extending guide plate 81 suitably fastened thereon and it partially guides a shutter comprising a main portion 82 having a stem 83 thereon to which a guide portion 84 is connected, the shutter being guided in a suitable groove in the front of the back plate of the casing, and being so arranged as to partly close the coin slot 8, the shutter being provided with a lug 85 arranged to be engaged by the device 59 on the arm 57 for moving the shutter to closing position. The portion 14 of the back plate has a pivot 86 thereon below the plane of the shutter and it supports a trigger device 87 having a cam face 88 to be engaged by the upper end of the arm 75, the upper portion of the trigger having a catch shoulder 89 to engage the shutter and hold it in closing position, or permissibly engage a suitable device on the shutter, such as a pivot 90 or the end of a rod 91 connected to the pivot, the rod being connected to a crank arm 92 secured to a rotative shaft 93. A coil spring 94 is suitably anchored to the casing and arranged to retract the shutter in order to open the coin slot, and preferably the spring is connected with the rod 91 and the crank arm. The shaft 93 is the actuating member of a counter 95 which will be seen through an aperture 96 in the front plate 20, the aperture having a suitable shutter 97. It should be understood that the counter can be variously operated so as to record or indicate the number of coins used in the operation of the lock.

In practical use a coin 98 is inserted through the slot 8 and descends by the force of gravity through the coin chute until it is stopped opposite to the front of the body portion of the lock bolt with a portion of the edge of the coin in the concavity 60. If then the knob 69 be turned in the only direction permissible the arm 62 is caused to swing and it in turn causes the controlling bar 54 to swing, as indicated in Fig. 6, the controlling bar pushing the coin which forces the arm 58 back and it in turn retracts the lock bolt, after which the door may be opened. As the arm 58 is swung back the arm 57 is swung away from the portion 14 of the casing and the device 59 engages the lug 85 and moves the shutter to closing position. After the door is opened the knob may be released and the spring 48 permitted to project the lock bolt, the coin then remaining in place as in Fig. 5. After the shutter has been moved to closed position the trigger device 87 tilts by the force of gravity into contact with the top of the lever arm 75, permitting the shoulder 89 to engage the shutter and hold it in position. The door is usually closed forcibly, causing the inclined face 46 of the lock bolt to strike the keeper 51 which causes retraction of the lock bolt, and after the door becomes closed the bolt is projected into the keeper. As the lock bolt is thus suddenly thrust back the controlling bar 54 remains suspended normally, as in Fig. 7, and the pressure of the lock bolt against the arm 58 is released, so that the weight of the coin causes the freely swinging arm 58 to release the coin which falls through the slot 12 into the coin box. The door may be now opened from the inside by turning the knob 73 which causes the arms 74 and 75 to be brought approximately to the position shown in Fig. 7, the arm 74 engaging the stud 47 and retracting the lock bolt, while the arm 75 engages the cam face 88 and lifts the device 87 approximately as shown by broken lines in Fig. 7. On further movement of the arm 75 the trigger is further tilted until the shoulder 89 releases the shutter which is retracted by its spring. The arm 75 is further moved in the operation of the knob until it has passed the trigger and is brought approximately to the position indicated by broken lines in Fig. 7 when the lock bolt is fully retracted, the position of the arms being indicated by broken lines also in Fig. 4. When the shutter is released and retracted it passes over the top of the trigger and holds the trigger approximately as shown in Fig. 4. Also, when the shutter is being retracted the lug 85 engages the stud 59 and pushes the arm 57 back to normal position as it appears in Figs. 4 and 5, and the lock is again set to receive the coin to be operated as before.

Having thus described the invention, what is claimed as new is:—

1. A coin-controlled lock including a projectable lock bolt, a spring arranged to project the bolt, a controlling bar pivotally supported above the lock bolt, a controlling lever pivotally supported above the lock bolt opposite to the controlling bar and with the bar forming a coin chute and having two arms, one of the lever arms being operated by the bar with a coin and engaging the

lock bolt to retract it, and a coin slot shutter movably supported above the coin chute and operated by the remaining one of the lever arms.

2. A coin-controlled lock including a projectable lock bolt, a spring arranged to project the bolt, a controlling bar pivotally supported above the lock bolt, a controlling lever pivotally supported above the lock bolt and having two arms, one of the lever arms being operated by the bar with a coin and engaging the lock bolt to retract it, a coin slot shutter movably supported and operated by the remaining one of the lever arms, a trigger pivotally supported to engage and hold the shutter when operated, a rotatively supported spindle, and a lever arm secured to the spindle and movable into engagement with the trigger to trip it to release the shutter.

3. A coin-controlled lock including a projectable lock bolt, a spring arranged to project the bolt, a controlling bar pivotally supported above the lock bolt, the bar constituting one wall of a coin chute, an operating arm pivotally supported above the lock bolt and having connection with the controlling bar to operate the bar, a lever pivotally supported to constitute an opposite wall of the coin chute, the lever having two arms arranged opposite to the controlling bar, one of the lever arms being arranged to be operated by the controlling bar with a coin and engaging the lock bolt to retract it, a coin slot shutter movably supported and operated by the remaining one of the lever arms, and a knob having a rotative spindle connected with the operating arm.

4. A coin-controlled lock including a movable lock bolt, a spring arranged to project the bolt, a controlling bar pivotally supported and extending downward and adjacent to the lock bolt, the bar constituting one wall of a coin chute, a controlling arm pivotally supported opposite to the bar and having connection with the lock bolt to retract the bolt, the arm being arranged to be connected by a coin with the bar to operate the arm, an operable operating arm pivotally supported and having connection with the controlling bar to pivotally move the bar, a horizontally movable coin slot shutter, a spring arranged to retract the shutter, a trigger movably supported to engage and hold the shutter when projected, means operated by the controlling arm to project the shutter, and means for moving the trigger to release the shutter.

5. A coin-controlled lock including a projectable lock bolt, a spring arranged to project the bolt, a controlling bar pivotally supported and having a longitudinal slot therein, an operating arm pivotally supported and having a wrist pin thereon extending into said slot, a lever pivotally supported and having two arms arranged opposite to the controlling bar, one of the lever arms engaging the lock bolt to retract it and having a coin-holding projection extending towards the controlling bar, a coin slot shutter movably supported and operated by the remaining one of the lever arms, a knob having a spindle connected with the operating arm, and a supported spring having connection with the operating arm.

6. A coin-controlled lock including a movable lock bolt, a spring arranged to project the bolt, a controlling bar pivotally supported and extending downward and adjacent to the lock bolt, a controlling arm pivotally supported and having connection with the lock bolt to retract the bolt, the arm having a projection extending towards the controlling bar to support a coin in contact with the bar, an operable operating arm pivotally supported and having connection with the controlling bar to pivotally move the bar towards the controlling arm, a spring arranged to move the operating arm and the controlling bar in the opposite direction, a movable coin slot shutter, a spring arranged to retract the shutter, means for projecting the shutter, a trigger pivotally supported to engage and hold the shutter when projected, a rotatively, supported spindle, and a lever having two arms and secured to the spindle, one of the lever arms having connection with the lock bolt to retract the bolt, the other of the lever arms being movable into engagement with the trigger to trip it to release the shutter.

7. In a coin-controlled lock, the combination of a lock bolt horizontally movable and having an abutment and a shoulder facing the abutment, a frame plate fixedly arranged opposite to the lock bolt and provided thereon with a pivot, a controlling bar having an upper portion pivotally supported and a lower portion arranged between the lock bolt and the frame plate, the bar constituting one wall of a coin chute, an operable operating arm supported on said pivot and operatively connected with the controlling bar to operate the bar, and a controlling arm having a portion pivotally supported and a lower portion arranged opposite to the lower portion of the controlling bar between the lock bolt and the frame plate and against said abutment, the controlling arm being operated by the bar with a coin, and a supported spring engaging said shoulder to project the lock bolt.

8. In a coin-controlled lock, the combination with a movable lock bolt having an abutment and a shoulder facing the abutment, of a controlling bar having an upper portion pivotally supported and a lower portion arranged between said abutment and said shoulder, a controlling arm having a portion pivotally supported and a lower

portion arranged between the abutment and the lower portion of said bar, a supported spring engaging said shoulder to project the lock bolt and thereby hold said abutment against said arm, and means for operating the controlling bar.

9. In a coin-controlled lock, the combination of a casing comprising a back plate and a front plate, a frame plate fixedly supported between the back plate and the front plate and provided thereon with a pivot, a lock bolt movable between the back plate and the frame plate, a spring arranged to project the lock bolt, a controlling bar pivotally supported above the lock bolt and extending downward and adjacent to the bolt and between the back plate and the frame plate, an operable operating arm supported on said pivot and having connection with the controlling bar to operate the bar, and a controlling arm pivotally supported above the lock bolt and extending downward opposite to the controlling bar to be connected therewith by a coin and having connection with the lock bolt to retract the bolt.

10. In a coin-controlled lock, the combination of a casing with a top having a coin slot therein, a shutter movably guided under said top to be projected to close said slot, a counter supported in the casing and having an operating device, a rod connected to the shutter and to said device, a spring connected to the casing and having connection with said rod and said device to simultaneously retract them, a lock bolt movably guided in the casing, a spring arranged to project the lock bolt, a controlling bar pivotally supported and extending downward and adjacent to the lock bolt, means for operating the controlling bar, a lever pivotally supported and having an arm arranged to retract the lock bolt and an arm arranged to project the shutter, a trigger movably supported in the casing to hold the shutter when projected, and separate means supported by the casing to simultaneously retract the lock bolt and actuate the trigger to release the shutter.

11. In a coin-controlled lock, the combination with a casing having a coin slot in its top, of a shutter movably guided under said top to be projected to close said slot, a spring connected to the casing and having connection with the shutter to retract the shutter, a lever pivotally supported and having connections to project the shutter, a trigger pivotally supported and having a shoulder to engage and hold the shutter when projected, the trigger having a cam face, a lock bolt movably guided and engaged by the lever to be retracted thereby, a spring arranged to project the lock bolt, a controlling bar arranged opposite to the lever and pivotally supported, an operating arm pivotally supported and having controlling connection with the controlling bar, a knob having a spindle detachably connected with the operating arm, a spindle rotatively supported and having a knob on one end thereof, the opposite end of the spindle having a key-connector thereon, a lever secured to the last described spindle and having an arm to engage and retract the lock bolt and also an arm movable into contact with the cam face of said trigger to actuate the trigger to release the shutter.

12. In a coin-controlled lock, the combination of a casing comprising a back plate and sides and also a top and a partition, the back plate constituting one wall of a coin chute, and a front plate removably secured to the sides and the top and the partition, said top and said partition having each a coin slot therein arranged one above the other; a frame plate secured to the inner side of said back plate to form an opposite wall of the coin chute and extending approximately to said partition, the frame plate having an opening therein, a lock bolt movably guided in the back of said plate above said partition and having a face forming a portion of the wall of the coin chute opposite to the frame plate and normally projecting through one of said sides, a spring supported in said casing and projecting said bolt, a controlling bar pivoted to said back plate and extending nearly to said partition, the bar constituting another wall of the coin chute, a controlling arm pivoted to said back plate and extending nearly to said partition at a distance from said bar to constitute an opposite wall of the coin chute and having engagement with said bolt to retract the bolt, the controlling arm being operated by the controlling bar with a coin, an operating arm pivoted to said frame plate and having a wrist pin thereon extending through said opening and having connection with said controlling bar, and a knob spindle rotatively supported in said front plate and connected with said operating arm.

In testimony whereof, we affix our signatures in presence of two witnesses.

EDWIN L. EDWARDS.
FRANK A. FARWELL.
FRANK O. WILEY.

Witnesses:
E. T. SILVIUS,
ROBERT LIEBRICH.

April 8, 1924. 1,489,883

E. L. EDWARDS ET AL

COIN CONTROLLED LOCK

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Fig. 1.

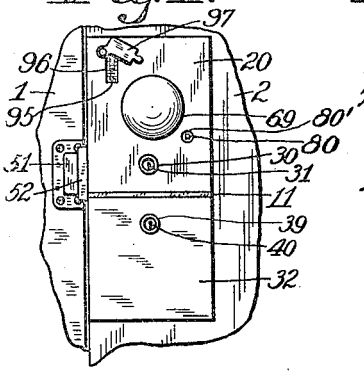


Fig. 2.

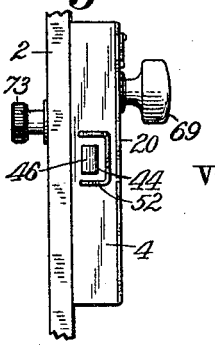
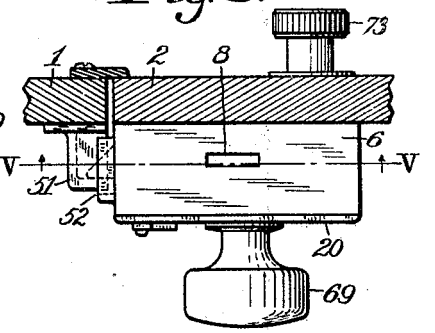


Fig. 3.



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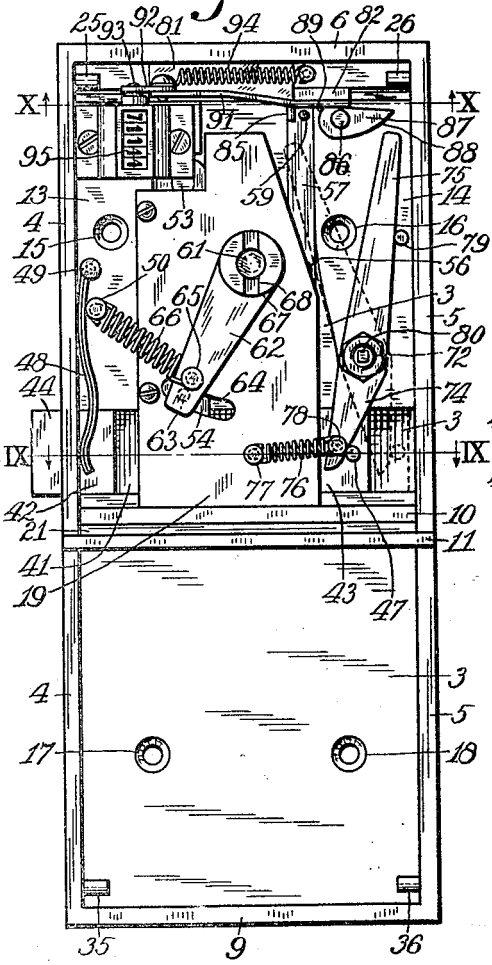

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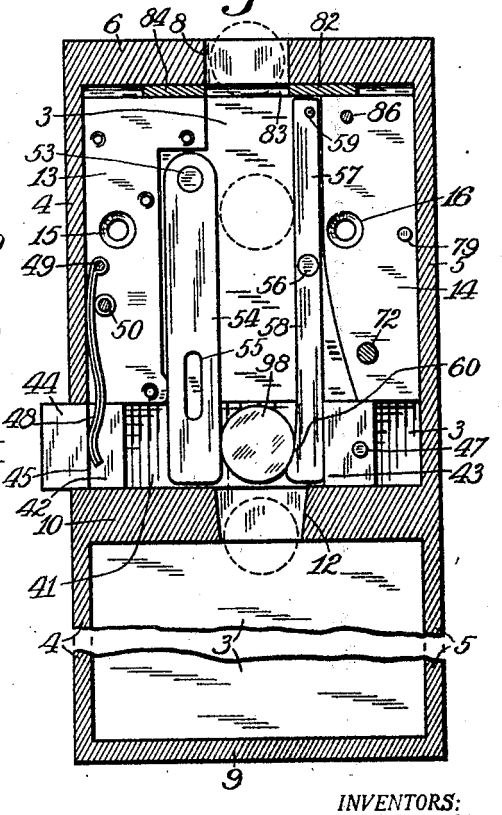

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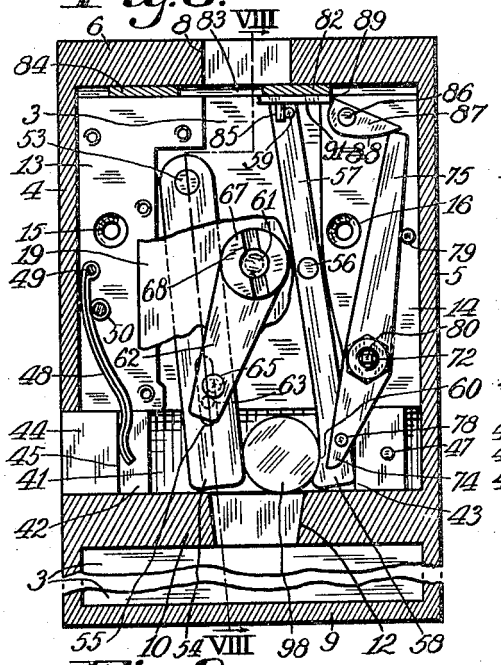
COIN CONTROLLED LOCK

Filed June 22, 1921 2 Sheets-Sheet 2

Fig. 6.



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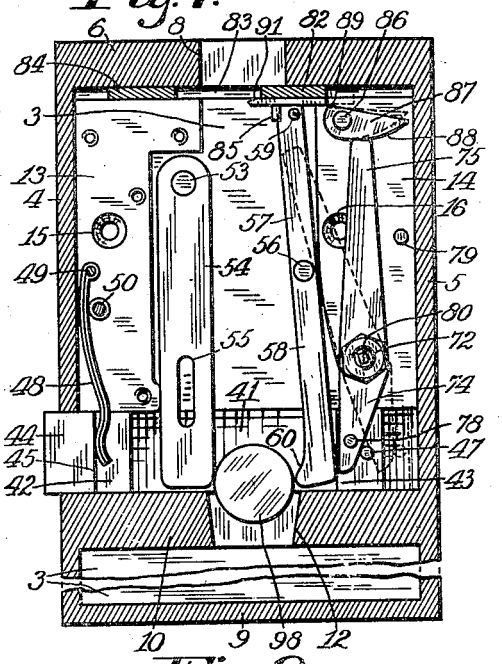

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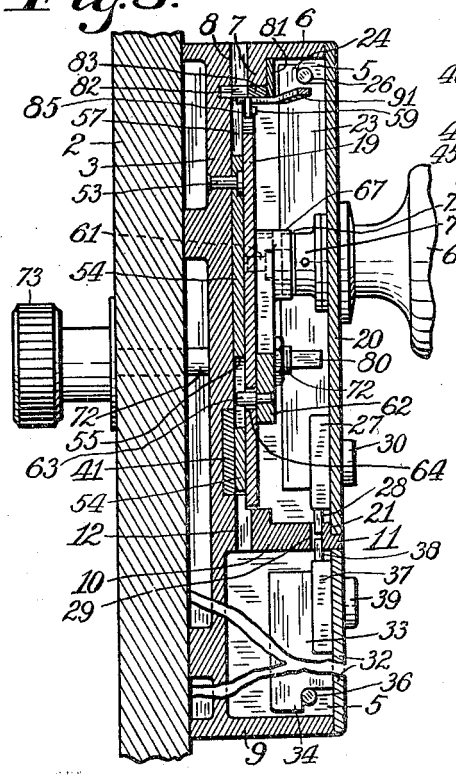

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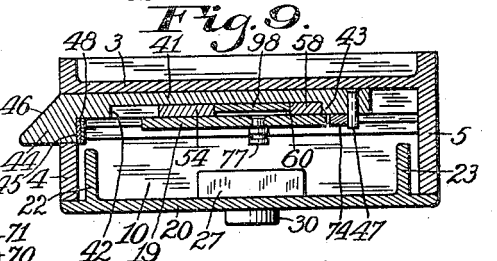

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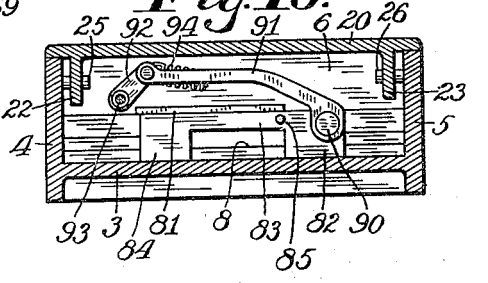

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UNITED STATES PATENT OFFICE.

EDWIN L. EDWARDS, FRANK A. FARWELL, AND FRANK O. WILEY, OF INDIANAPOLIS, INDIANA, ASSIGNORS TO UNIVERSAL SERVICE CORPORATION, OF INDIANAPOLIS, INDIANA, A CORPORATION OF INDIANA.

COIN-CONTROLLED LOCK.

Application filed June 22, 1921. Serial No. 479,495.

To all whom it may concern:

Be it known that we, EDWIN L. EDWARDS, FRANK A. FARWELL, and FRANK O. WILEY, citizens of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Coin-Controlled Lock, of which the following is a specification, reference being had to the accompanying drawings, and to the figures of reference marked thereon.

This invention relates to a lock of the type that is used on doors of toilet rooms and on doors of rooms or apartments to which entrance may be gained by the deposit of a fee, the invention having reference more particularly to a lock that is designed to be operated to unlock a door by means of a coin inserted in the lock.

An object of the invention is to provide a coin-controlled lock which shall be so constructed as to not be costly, but shall be simple and reliable and not be liable to become deranged nor troublesome in use.

Another object is to provide an improved coin-controlled lock and coin box combined which shall be of such construction as to permit compactness of mechanism and provide for large coin capacity, and which shall be of such structure as to be durable and economical in use.

With the above-mentioned and other objects in view, the invention consists in a coin-controlled lock having operative mechanism of improved structure permitting coins to pass progressively by the force of gravity through the lock-controlled means and into the coin box; and, the invention consists also further in the novel parts and in the combinations and arrangements of parts as hereinafter particularly described and further pointed out in the accompanying claims.

Referring to the drawings, Figure 1 is a front elevation of the improved lock in connection with a door and door frame of which fragments are shown; Fig. 2 is a fragmentary edge view of the door and the lock applied thereto; Fig. 3 is a top plan of the improved lock and a keeper with which the lock co-operates, on an enlarged scale, as applied to a door and door frame of which a fragmentary horizontal section is shown; Fig. 4 is a front elevation of the improved lock minus its covers, on an enlarged scale; Fig. 5 is a fragmentary vertical section of the lock approximately on the line V—V in Fig. 3; Fig. 6 is a view similar to Fig. 5, but with operative parts in different positions; Fig. 7 is a view similar to Figs. 5 and 6 except that the operative parts are shown in different positions; Fig. 8 is a section approximately on the line VIII—VIII in Fig. 6 on an enlarged scale, as the lock is applied to a door; Fig. 9 is a horizontal section approximately on the line IX—IX in Fig 4; and, Fig. 10 is a horizontal section approximately on the line X—X in Fig. 4.

Similar reference characters in the different figures of the drawings indicate corresponding or like elements or features of construction herein referred to in detail.

In the drawings the numeral 1 indicates a door frame and 2 indicates a door provided with the improved lock which as preferably constructed comprises a back plate 3, side walls 4 and 5, a top 6 having a projecting guide portion 7 on its inner side in which is a coin slot 8, a bottom 9 connected to the side walls and the back plate, and a partition 10, constituting the principal portion of a casing having an upper chamber for the lock mechanism and a lower chamber to hold the spent coins. The partition 10 preferably has a guide rib 11 projecting beyond the plane of the front of the side walls, and the partition has a slot 12 therein to permit the coins to pass into the coin box, the slot preferably being broader at its top than at its lower end. The back plate 3 has a relatively thick portion 13 adjacent to the side wall 4 and a thick portion 14 adjacent to the side wall 5. The back plate has screw holes 15 and 16 in the thicker portions respectively to receive screws whereby to secure the casing to the door, the lower portion of the back plate having also screw holes 17 and 18 to receive securing screws. A guide plate 19 is secured to the front of the portion 13 of the back plate and extends down to the partition 10 and also over nearly to the thicker portions 14 of the back plate.

The upper chamber of the casing is provided with a front plate 20, the lower end of the plate preferably being arranged in connection with a stop shoulder 21 corresponding to the front of the partition 10.

The inner side of the front plate preferably has ribs 22 and 23 thereon to stiffen the plate and also guide it to position between the side walls of the casing, and each rib has a projection 24 on its end that is normally adjacent to the top 6, the projections normally extending behind suitably supported keepers 25 and 26 whereby to secretly lock the upper portion of the front plate securely in place. The lower portion of the front plate is provided on its inner side with a lock 27 from which a lock bolt 28 is projected into a slot 29 with which the partition 10 is provided. The lock has a guide barrel 30 thereon in which a key cylinder 31 is arranged. The coin box is provided with a front plate 32 which also has ribs 33 on its inner side that are provided each with a projection 34 normally arranged adjacent to the bottom 9, the projections engaging keepers 35 and 36 suitably supported adjacent to the bottom. The inner side of the upper portion of the front plate 32 is provided with a lock 37 from which a lock bolt 38 is projected into the slot 29, and the lock is provided with a guide barrel 39 in which a key cylinder 40 is arranged.

A lock bolt is provided which has a body portion 41 and is horizontally arranged upon or above the partition 10, the back plate 3 being recessed to receive the bolt. The forward portion of the lock bolt has a relatively thick portion 42 and the rearward or opposite end has a relatively thick abutment portion 43 on the front of the body portion, and the bolt has a thicker head portion 44 which provides a shoulder 45 at the rearward end thereof, the head portion being movably guided in the side wall 4 of the casing and normally projecting therefrom, and it has a beveled or inclined back 46 to engage the front of a keeper. The lock bolt is provided with a stud 47 which projects from the front of the abutment portion 43. A plate spring 48 is arranged adjacent to the inner side of the wall 4 and is connected to a fixed stud 49 from which it extends to and beyond a tension stud 50 to the shoulder 45 and so that it automatically projects the lock bolt into a keeper 51 secured to the outer side of the door frame 1. Preferably the wall 4 has a guard 52 thereon that partially covers the front and upper and lower portions of the keeper to prevent the insertion of any instrument between the lock casing and the keeper in an effort to retract the lock bolt.

The upper portion of the back plate 3 has a pivot 53 thereon to which a controlling bar 54 is connected, the bar extending downward and adjacent to the front of the body portion 41 of the lock bolt, and the bar has a vertical slot 55 therein. The back plate 3 is provided also with another pivot 56 at a suitable distance from the bar 54, the pivot 56 being lower than the pivot 53, and it supports a controlling lever between its ends so as to provide an upper arm 57 and a lower arm 58, the upper arm having a stud 59 thereon adjacent to its upper end. The controlling lever and the controlling bar are arranged between the thicker portions 13 and 14 of the back plate and a suitable distance apart to receive a coin of certain denomination between them, and the lower arm 58 preferably has a concavity 60 in the edge thereof that is presented towards the bar 54, to receive a portion of the coin and temporarily hold the coin in contact with the bar 54. The arm 58 extends against the abutment portion 43 of the lock bolt and adjacent to the thinner portion 41, the concavity preferably being arranged so as to retain the coin opposite to the portion 41. The lower end of the arm 58 preferably is relatively broad so that a portion thereof projects laterally to form the lower portion of the concavity. It will be seen that the back plate 3, the guide plate 19 which constitutes a frame member, and the bar 54 and the opposite lever constitute a coin chute.

The plate 19 is provided with a pivot 61 to which a lever or operating arm 62 is connected, the arm 62 having a wrist pin 63 thereon that extends through a slot 64 in the plate 19 and extends also into the slot 55. The arm 62 has a lug 65 thereon to which a coil spring 66 is connected, the spring being suitably anchored preferably to the stud 50, to yieldingly hold the bar 54 against the adjacent lower portion of the back plate portion 13. The arm 62 has a boss 67 on its front and the boss has a key slot 68 in its front portion. A knob 69 has a suitable spindle member 70 that is rotatively arranged in the front plate 20 in alinement with the pivot 61 and so that the knob shall be carried by the front plate and prevented from being removed when the front plate 20 is secured to the remaining portion of the lock casing. The knob spindle has a key 71 on its inner end that extends into the slot 68 which enables the knob to move the lever arm 62 and the arm to move the controlling bar 54.

For the purpose of enabling the door to be opened by a person within a room or apartment a spindle 72 is arranged so as to extend through the door 2 and through the back plate of the lock, and it has a knob 73 fastened thereto at the inner side of the door. A lever is secured between its ends to the spindle 72 so as to have a downward extending arm 74 and an upward extending arm 75. The arm 74 extends partially across the front of the abutment portion 43 of the lock bolt and between the stud 47 and the adjacent edge of the frame member 19,

and preferably the arm is yieldingly drawn towards the frame member by means of a coil spring 76 anchored to a stud 77 secured to the member 19, the spring being connected to a stud 78 carried by the arm 74, but in some cases the spring may be omitted. The arm 75 is suitably stopped in its movement towards the side 5 of the casing, either directly by the side or by means of a stud 79 as shown, to limit the movement of the lock bolt when projected by the spring 48. The inner end of the spindle 72 which is within the casing has a squared or peculiarly shaped portion 80 adapted to receive a special key to be inserted through a key hole 80′ in the front plate 20, so that in special cases the door may be unlocked from the outside without the use of a coin.

The projecting portion 7 of the top 6 has a downwardly extending guide plate 81 suitably fastened thereon and it partially guides a shutter comprising a main portion 82 having a stem 83 thereon to which a guide portion 84 is connected, the shutter being guided in a suitable groove in the front of the back plate of the casing, and being so arranged as to partly close the coin slot 8, the shutter being provided with a lug 85 arranged to be engaged by the device 59 on the arm 57 for moving the shutter to closing position. The portion 14 of the back plate has a pivot 86 thereon below the plane of the shutter and it supports a trigger device 87 having a cam face 88 to be engaged by the upper end of the arm 75, the upper portion of the trigger having a catch shoulder 89 to engage the shutter and hold it in closing position, or permissibly engage a suitable device on the shutter, such as a pivot 90 or the end of a rod 91 connected to the pivot, the rod being connected to a crank arm 92 secured to a rotative shaft 93. A coil spring 94 is suitably anchored to the casing and arranged to retract the shutter in order to open the coin slot, and preferably the spring is connected with the rod 91 and the crank arm. The shaft 93 is the actuating member of a counter 95 which will be seen through an aperture 96 in the front plate 20, the aperture having a suitable shutter 97. It should be understood that the counter can be variously operated so as to record or indicate the number of coins used in the operation of the lock.

In practical use a coin 98 is inserted through the slot 8 and descends by the force of gravity through the coin chute until it is stopped opposite to the front of the body portion of the lock bolt with a portion of the edge of the coin in the concavity 60. If then the knob 69 be turned in the only direction permissible the arm 62 is caused to swing and it in turn causes the controlling bar 54 to swing, as indicated in Fig. 6, the controlling bar pushing the coin which forces the arm 58 back and it in turn retracts the lock bolt, after which the door may be opened. As the arm 58 is swung back the arm 57 is swung away from the portion 14 of the casing and the device 59 engages the lug 85 and moves the shutter to closing position. After the door is opened the knob may be released and the spring 48 permitted to project the lock bolt, the coin then remaining in place as in Fig. 5. After the shutter has been moved to closed position the trigger device 87 tilts by the force of gravity into contact with the top of the lever arm 75, permitting the shoulder 89 to engage the shutter and hold it in position. The door is usually closed forcibly, causing the inclined face 46 of the lock bolt to strike the keeper 51 which causes retraction of the lock bolt, and after the door becomes closed the bolt is projected into the keeper. As the lock bolt is thus suddenly thrust back the controlling bar 54 remains suspended normally, as in Fig. 7, and the pressure of the lock bolt against the arm 58 is released, so that the weight of the coin causes the freely swinging arm 58 to release the coin which falls through the slot 12 into the coin box. The door may be now opened from the inside by turning the knob 73 which causes the arms 74 and 75 to be brought approximately to the position shown in Fig. 7, the arm 74 engaging the stud 47 and retracting the lock bolt, while the arm 75 engages the cam face 88 and lifts the device 87 approximately as shown by broken lines in Fig. 7. On further movement of the arm 75 the trigger is further tilted until the shoulder 89 releases the shutter which is retracted by its spring. The arm 75 is further moved in the operation of the knob until it has passed the trigger and is brought approximately to the position indicated by broken lines in Fig. 7 when the lock bolt is fully retracted, the position of the arms being indicated by broken lines also in Fig. 4. When the shutter is released and retracted it passes over the top of the trigger and holds the trigger approximately as shown in Fig. 4. Also, when the shutter is being retracted the lug 85 engages the stud 59 and pushes the arm 57 back to normal position as it appears in Figs. 4 and 5, and the lock is again set to receive the coin to be operated as before.

Having thus described the invention, what is claimed as new is:—

1. A coin-controlled lock including a projectable lock bolt, a spring arranged to project the bolt, a controlling bar pivotally supported above the lock bolt, a controlling lever pivotally supported above the lock bolt opposite to the controlling bar and with the bar forming a coin chute and having two arms, one of the lever arms being operated by the bar with a coin and engaging the

lock bolt to retract it, and a coin slot shutter movably supported above the coin chute and operated by the remaining one of the lever arms.

2. A coin-controlled lock including a projectable lock bolt, a spring arranged to project the bolt, a controlling bar pivotally supported above the lock bolt, a controlling lever pivotally supported above the lock bolt and having two arms, one of the lever arms being operated by the bar with a coin and engaging the lock bolt to retract it, a coin slot shutter movably supported and operated by the remaining one of the lever arms, a trigger pivotally supported to engage and hold the shutter when operated, a rotatively supported spindle, and a lever arm secured to the spindle and movable into engagement with the trigger to trip it to release the shutter.

3. A coin-controlled lock including a projectable lock bolt, a spring arranged to project the bolt, a controlling bar pivotally supported above the lock bolt, the bar constituting one wall of a coin chute, an operating arm pivotally supported above the lock bolt and having connection with the controlling bar to operate the bar, a lever pivotally supported to constitute an opposite wall of the coin chute, the lever having two arms arranged opposite to the controlling bar, one of the lever arms being arranged to be operated by the controlling bar with a coin and engaging the lock bolt to retract it, a coin slot shutter movably supported and operated by the remaining one of the lever arms, and a knob having a rotative spindle connected with the operating arm.

4. A coin-controlled lock including a movable lock bolt, a spring arranged to project the bolt, a controlling bar pivotally supported and extending downward and adjacent to the lock bolt, the bar constituting one wall of a coin chute, a controlling arm pivotally supported opposite to the bar and having connection with the lock bolt to retract the bolt, the arm being arranged to be connected by a coin with the bar to operate the arm, an operable operating arm pivotally supported and having connection with the controlling bar to pivotally move the bar, a horizontally movable coin slot shutter, a spring arranged to retract the shutter, a trigger movably supported to engage and hold the shutter when projected, means operated by the controlling arm to project the shutter, and means for moving the trigger to release the shutter.

5. A coin-controlled lock including a projectable lock bolt, a spring arranged to project the bolt, a controlling bar pivotally supported and having a longitudinal slot therein, an operating arm pivotally supported and having a wrist pin thereon extending into said slot, a lever pivotally supported and having two arms arranged opposite to the controlling bar, one of the lever arms engaging the lock bolt to retract it and having a coin-holding projection extending towards the controlling bar, a coin slot shutter movably supported and operated by the remaining one of the lever arms, a knob having a spindle connected with the operating arm, and a supported spring having connection with the operating arm.

6. A coin-controlled lock including a movable lock bolt, a spring arranged to project the bolt, a controlling bar pivotally supported and extending downward and adjacent to the lock bolt, a controlling arm pivotally supported and having connection with the lock bolt to retract the bolt, the arm having a projection extending towards the controlling bar to support a coin in contact with the bar, an operable operating arm pivotally supported and having connection with the controlling bar to pivotally move the bar towards the controlling arm, a spring arranged to move the operating arm and the controlling bar in the opposite direction, a movable coin slot shutter, a spring arranged to retract the shutter, means for projecting the shutter, a trigger pivotally supported to engage and hold the shutter when projected, a rotatively, supported spindle, and a lever having two arms and secured to the spindle, one of the lever arms having connection with the lock bolt to retract the bolt, the other of the lever arms being movable into engagement with the trigger to trip it to release the shutter.

7. In a coin-controlled lock, the combination of a lock bolt horizontally movable and having an abutment and a shoulder facing the abutment, a frame plate fixedly arranged opposite to the lock bolt and provided thereon with a pivot, a controlling bar having an upper portion pivotally supported and a lower portion arranged between the lock bolt and the frame plate, the bar constituting one wall of a coin chute, an operable operating arm supported on said pivot and operatively connected with the controlling bar to operate the bar, and a controlling arm having a portion pivotally supported and a lower portion arranged opposite to the lower portion of the controlling bar between the lock bolt and the frame plate and against said abutment, the controlling arm being operated by the bar with a coin, and a supported spring engaging said shoulder to project the lock bolt.

8. In a coin-controlled lock, the combination with a movable lock bolt having an abutment and a shoulder facing the abutment, of a controlling bar having an upper portion pivotally supported and a lower portion arranged between said abutment and said shoulder, a controlling arm having a portion pivotally supported and a lower

portion arranged between the abutment and the lower portion of said bar, a supported spring engaging said shoulder to project the lock bolt and thereby hold said abutment against said arm, and means for operating the controlling bar.

9. In a coin-controlled lock, the combination of a casing comprising a back plate and a front plate, a frame plate fixedly supported between the back plate and the front plate and provided thereon with a pivot, a lock bolt movable between the back plate and the frame plate, a spring arranged to project the lock bolt, a controlling bar pivotally supported above the lock bolt and extending downward and adjacent to the bolt and between the back plate and the frame plate, an operable operating arm supported on said pivot and having connection with the controlling bar to operate the bar, and a controlling arm pivotally supported above the lock bolt and extending downward opposite to the controlling bar to be connected therewith by a coin and having connection with the lock bolt to retract the bolt.

10. In a coin-controlled lock, the combination of a casing with a top having a coin slot therein, a shutter movably guided under said top to be projected to close said slot, a counter supported in the casing and having an operating device, a rod connected to the shutter and to said device, a spring connected to the casing and having connection with said rod and said device to simultaneously retract them, a lock bolt movably guided in the casing, a spring arranged to project the lock bolt, a controlling bar pivotally supported and extending downward and adjacent to the lock bolt, means for operating the controlling bar, a lever pivotally supported and having an arm arranged to retract the lock bolt and an arm arranged to project the shutter, a trigger movably supported in the casing to hold the shutter when projected, and separate means supported by the casing to simultaneously retract the lock bolt and actuate the trigger to release the shutter.

11. In a coin-controlled lock, the combination with a casing having a coin slot in its top, of a shutter movably guided under said top to be projected to close said slot, a spring connected to the casing and having connection with the shutter to retract the shutter, a lever pivotally supported and having connections to project the shutter, a trigger pivotally supported and having a shoulder to engage and hold the shutter when projected, the trigger having a cam face, a lock bolt movably guided and engaged by the lever to be retracted thereby, a spring arranged to project the lock bolt, a controlling bar arranged opposite to the lever and pivotally supported, an operating arm pivotally supported and having controlling connection with the controlling bar, a knob having a spindle detachably connected with the operating arm, a spindle rotatively supported and having a knob on one end thereof, the opposite end of the spindle having a key-connector thereon, a lever secured to the last described spindle and having an arm to engage and retract the lock bolt and also an arm movable into contact with the cam face of said trigger to actuate the trigger to release the shutter.

12. In a coin-controlled lock, the combination of a casing comprising a back plate and sides and also a top and a partition, the back plate constituting one wall of a coin chute, and a front plate removably secured to the sides and the top and the partition, said top and said partition having each a coin slot therein arranged one above the other; a frame plate secured to the inner side of said back plate to form an opposite wall of the coin chute and extending approximately to said partition, the frame plate having an opening therein, a lock bolt movably guided in the back of said plate above said partition and having a face forming a portion of the wall of the coin chute opposite to the frame plate and normally projecting through one of said sides, a spring supported in said casing and projecting said bolt, a controlling bar pivoted to said back plate and extending nearly to said partition, the bar constituting another wall of the coin chute, a controlling arm pivoted to said back plate and extending nearly to said partition at a distance from said bar to constitute an opposite wall of the coin chute and having engagement with said bolt to retract the bolt, the controlling arm being operated by the controlling bar with a coin, an operating arm pivoted to said frame plate and having a wrist pin thereon extending through said opening and having connection with said controlling bar, and a knob spindle rotatively supported in said front plate and connected with said operating arm.

In testimony whereof, we affix our signatures in presence of two witnesses.

EDWIN L. EDWARDS.
FRANK A. FARWELL.
FRANK O. WILEY.

Witnesses:
E. T. SILVIUS,
ROBERT LIEBRICH.

April 28, 1925. 1,535,366

E. L. EDWARDS

PROTECTOR FOR X RAY TUBES

Filed April 7, 1921

Fig. 1.

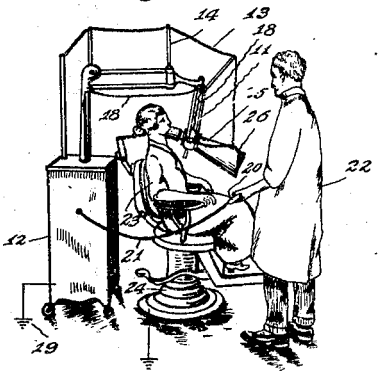


Fig. 3.

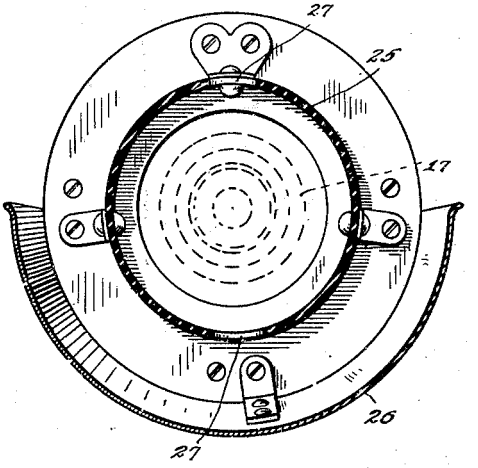


Fig. 2.

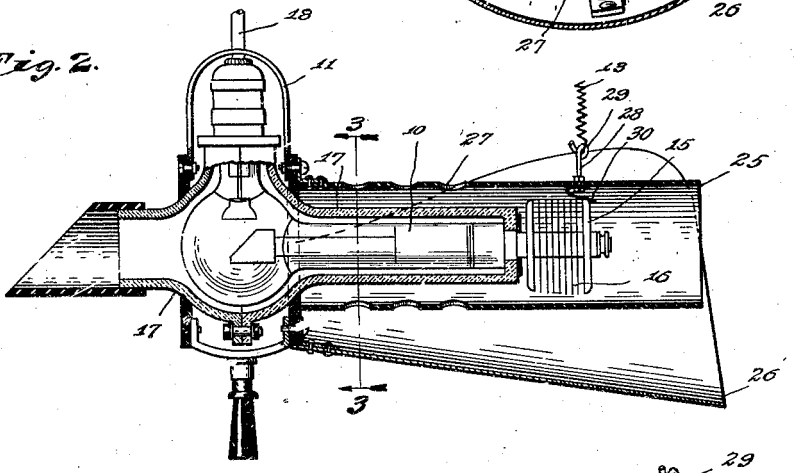


Fig. 5.

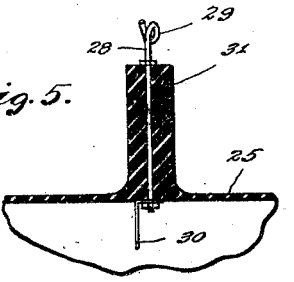


Fig. 4.

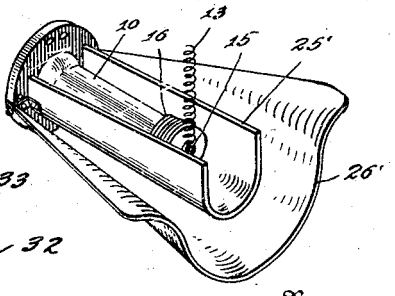
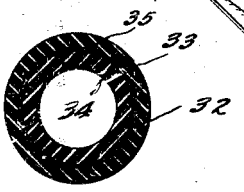


Fig. 6.



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Patented Apr. 28, 1925. 1,535,366

UNITED STATES PATENT OFFICE.

EDWIN L. EDWARDS, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO EDWARDS X-RAY CORPORATION, OF INDIANAPOLIS, INDIANA, A CORPORATION OF INDIANA.

PROTECTOR FOR X-RAY TUBES.

Application filed April 7, 1921. Serial No. 459,273.

To all whom it may concern:

Be it known that I, EDWIN L. EDWARDS, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Protector for X-Ray Tubes, of which the following is a specification.

In the operation of X-ray machines, the patient or the operator is frequently shocked, and sometimes severely injured or even killed, by getting too close to the high voltage end of the tube. While this sometimes happens through carelessness, it frequently happens through failure to appreciate the nature of the high voltage used, or through some involuntary movement, especially on the part of the patient, at the time the tube starts working, for frequently the patient will throw up his hands when he sees the tube light up.

It is the object of my present invention to provide a full and sufficient protection for the high-voltage end of an X-ray tube, which operates both by insulation to prevent the current from jumping from such high-voltage end to the operator or patient, and by grounding and carrying away any currents which may succeed in jumping in spite of the insulation. By this double protection, the danger from the use of X-ray tubes is practically eliminated.

In carrying out my invention, I provide an insulating shield at the high-voltage end of an X-ray tube, and provide in addition and somewhat further away from such high-voltage end a grounded metallic shield. Both shields are carried by and partake of the adjusting movements of the X-ray tube. Either or both shields may completely encircle the tube, or may be open at the top, as desired, as the greatest danger is of touching the tube from the bottom or sides.

The accompanying drawing illustrates my invention. Fig. 1 is a side view of a dental X-ray machine in operation, showing its relation to dentist and patient, and showing one form of protector for the high-voltage end of such tube; Fig. 2 is a longitudinal section through an X-ray tube and its mounting, equipped with my protector; Fig. 3 is an enlarged transverse section on the line 3—3 of Fig. 2; Fig. 4 is a perspective view showing a modified form of protector open at the top; Fig. 5 is a detail of a modification in which the lower end of the high-voltage supply wire to the tube is attached somewhat differently from the way it is shown in Fig. 2; and Fig. 6 is a transverse section through a modified form of protector, in which the metallic shield is embedded in the insulating shield.

The X-ray tube 10 is carried by an adjustable carrier 11 mounted on a suitable cabinet 12, in which is mounted the necessary apparatus, including the transformer, for supplying high-tension currents to the conductor 13, which leads over suitable insulating support rods 14 to the high-tension end 15 of the X-ray tube shown, this high-tension end is usually provided with a radiator 16 for dissipating the heat produced. The X-ray tube proper is usually mounted in a lead-glass holder 17, for protecting the operator and the patient from X-rays except at the point from which it is desired that they should be projected; this lead-glass holder is commonly used, but the high-tension end 15 with the radiator 16 is located outside of it, and the protection for which the present invention is intended is from high-voltage currents and not from X-ray burns. The other side of the X-ray tube shown is connected by a conductor 18 to the grounded side of the circuit, indicated by having the cabinet 12 grounded at 19. The apparatus within the cabinet may be controlled by a portable hand switch 20, leading to the cabinet by a flexible conductor 21 so that it may be carried by the operator 22 to any suitable position. The tube 10 is adjusted to the patient 23, who is seated in the chair 24, which may be grounded in the usual manner. All the construction so far described may be of any standard or convenient type, as it is merely incidental.

The high-voltage end 15 of the tube, and the radiator 16, are protected and guarded by my double shield against being accidentally touched. In the forms shown in Figs. 1, 2, and 3, this double shield comprises a tube 25, of insulation, which completely surrounds the high-voltage end of the tube, the radiator 16, and the holder 17 near such high-voltage end, and which projects some distance beyond such high-voltage end so that the operator will not touch such end through the open end of the tube 25. This tube is of some suitable insulating material, and is carried by the carrier 11, as by being bolted thereto at one end. Supple-

menting this insulating shield 25 I provide a conducting shield 26, suitably made of sheet metal, which conducting shield is also bolted to the carrier 11 and thereby grounded. The conducting shield 26 as shown is trough-shaped, open at the top, and serves to prevent the operator or the patient from touching the insulating shield 25 or the high-voltage end of the tube. The insulating shield is preferably provided with ventilating openings 27 near the end by which it is supported, for permitting air circulation to cool the X-ray tube and its radiator 16. When the insulating shield is tubular, it supports a conductor 28 which extends through its wall and is provided on the outside with a loop 29 to which the conductor 13 may be attached, and is provided on the inside with a flexible metal member 30 which will bear against the radiator 16, thus forming a connection to the high-voltage end of the tube. The conductor 28 may be unprotected, as shown in Fig. 2, or may be located in a lateral boss 31 of insulation, projecting from the insulating tube 25, as shown in Fig. 5.

If desired, the insulating shield need not project entirely around the high-voltage end of the tube, but may be open at the top, as the insulating shield 25′ is shown in Fig. 4. In this figure, both the insulating shield 25′ and the grounded conducting shield 26′ are trough-shaped, open at the top. With this arrangement, the conductor 13 may be connected directly to the high-voltage end 15 of the X-ray tube.

If desired, the insulating and conducting shields may be combined into a unitary structure. This is shown in Fig. 6, where a tubular conducting shield 32, which may be a screen, is embedded in the wall of a tubular insulating shield 33. This structure may be formed by an inner insulating tube 34 on the outside of which is slipped the conducting tube or screen 32, upon which is slipped an outer insulating tube 35 embedding the conducting tube 32 between the inner and outer insulating tubes 34 and 35. The conducting tube 33 is grounded in the same way as is the trough-like conducting shield 26 of the other forms.

In operation the insulating shield 25, 25′, or 34 ordinarily prevents any high-voltage currents from jumping either from the high-voltage end 15 of the tube or from the radiator 16. For smaller tubes it may sometimes be sufficient to use this insulating shield alone. By itself, it prevents the operator or patient from touching the charged parts, save from the top when the trough form of conducting shield is used as in Fig. 4. I prefer, however, to use the grounded conducting shield 26 or 32 in addition, outside of the insulating shield. If the insulation breaks down, as under an excessively high voltage produced by a surge on the line, any spark which jumps in spite of the insulating shield strikes and is caught by such grounded conducting shield, and is carried harmlessly to the ground. The grounded conducting shield prevents the patient or operator from touching the insulating shield, as well as taking all the sparks which jump from the high-voltage end of the tube, thus doubly protecting the patient and the operator; and the insulating shield serves under normal circumstances to prevent the sparks from jumping out even to the conducting shield, thus normally preventing the patient and the operator from being even startled by the jumping of a spark.

I claim as my invention:

1. A protector for X-ray tubes, comprising an insulating shield which guards the high-voltage end of an X-ray tube, and a grounded conducting shield outside of said insulating shield, both said shields extending beneath and upward on both sides of said high voltage end and being fixed relatively to the X-ray tube, said conducting shield being spaced from said insulating shield in the vicinity of said high-voltage end.

2. A protector for X-ray tubes, comprising an insulating shield which guards the high-voltage end of an X-ray tube, and a grounded conducting shield outside of said insulating shield, both said shields being fixed relatively to the X-ray tube, said conducting shield being spaced from said insulating shield in the vicinity of said high-voltage end.

In witness whereof, I have hereunto set my hand at Indianapolis, Indiana, this 23rd day of March, A. D. one thousand nine hundred and twenty-one.

EDWIN L. EDWARDS.

Mar. 27, 1923. 1,450,025

E. L. EDWARDS ET AL

SAFETY X-RAY APPARATUS

Filed Nov. 6, 1920 6 sheets-sheet 1

Fig. 1.

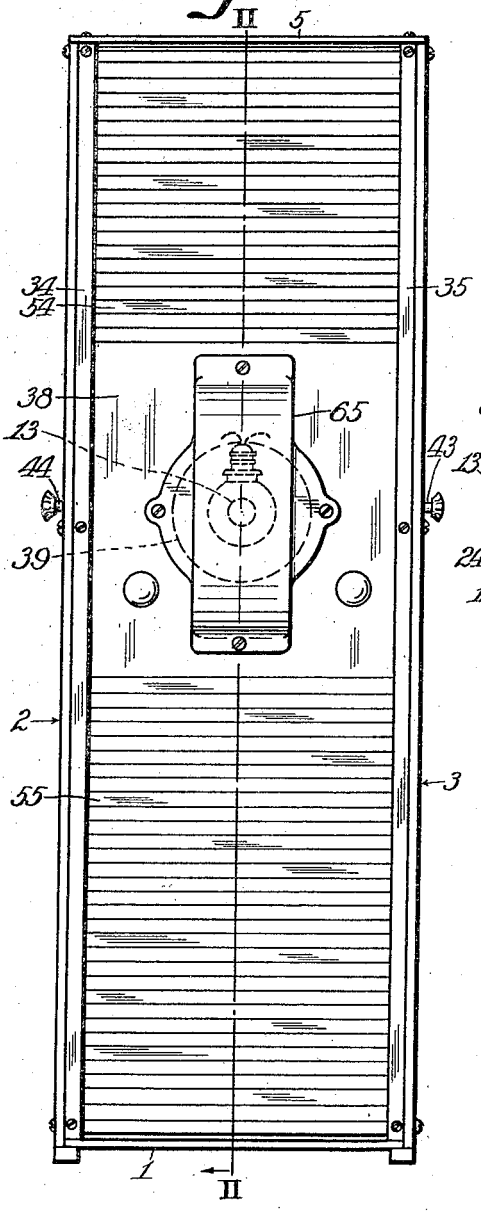
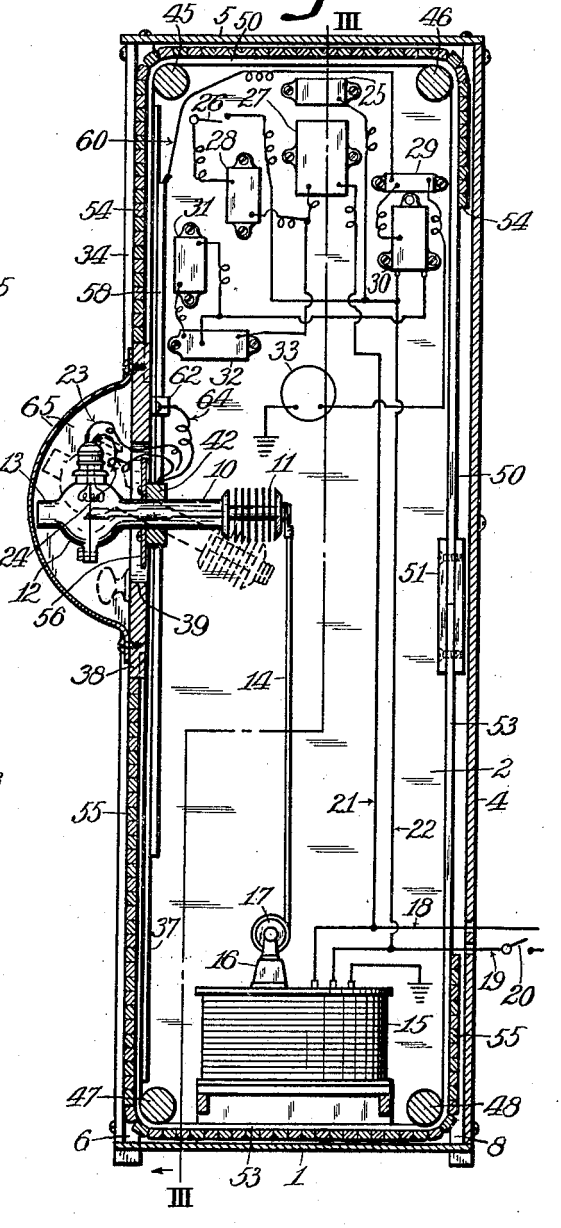


Fig. 2.



WITNESS:

R. F. Buckley.

R. A. Sample.

INVENTORS:

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Mar. 27, 1923. 1,450,025

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SAFETY X-RAY APPARATUS

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Fig. 3.

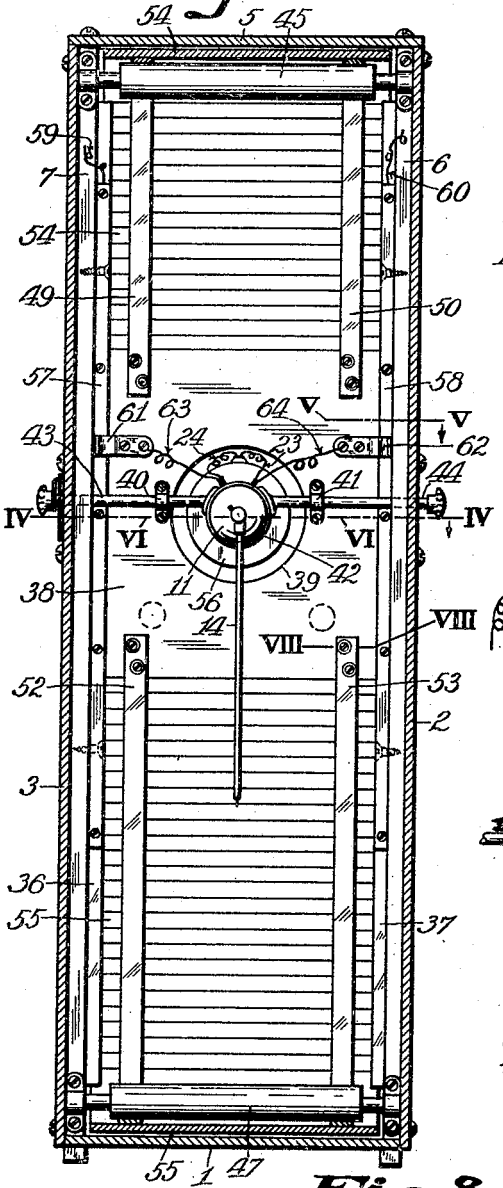


Fig. 4.

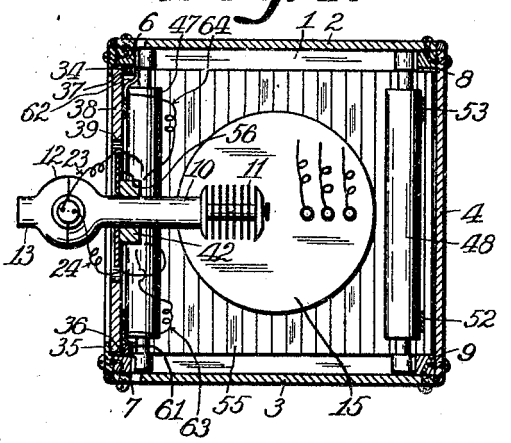


Fig. 5.

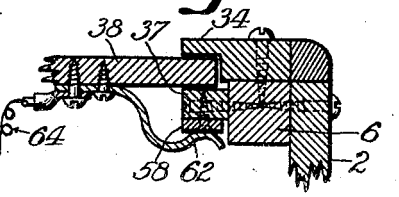


Fig. 6.

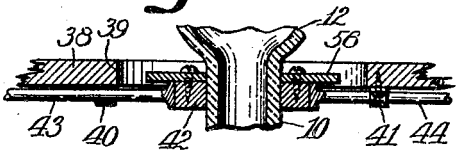


Fig. 7.

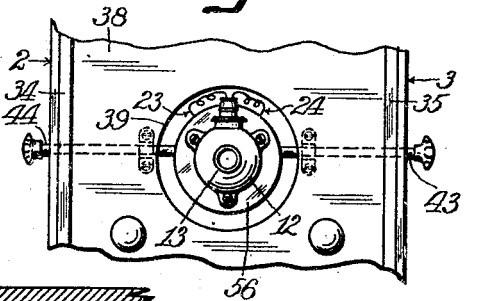
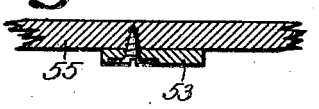


Fig. 8.



WITNESS:

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Mar. 27, 1923. 1,450,025

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SAFETY X-RAY APPARATUS

Filed Nov. 6, 1920 6 sheets-sheet 3

Fig. 9.

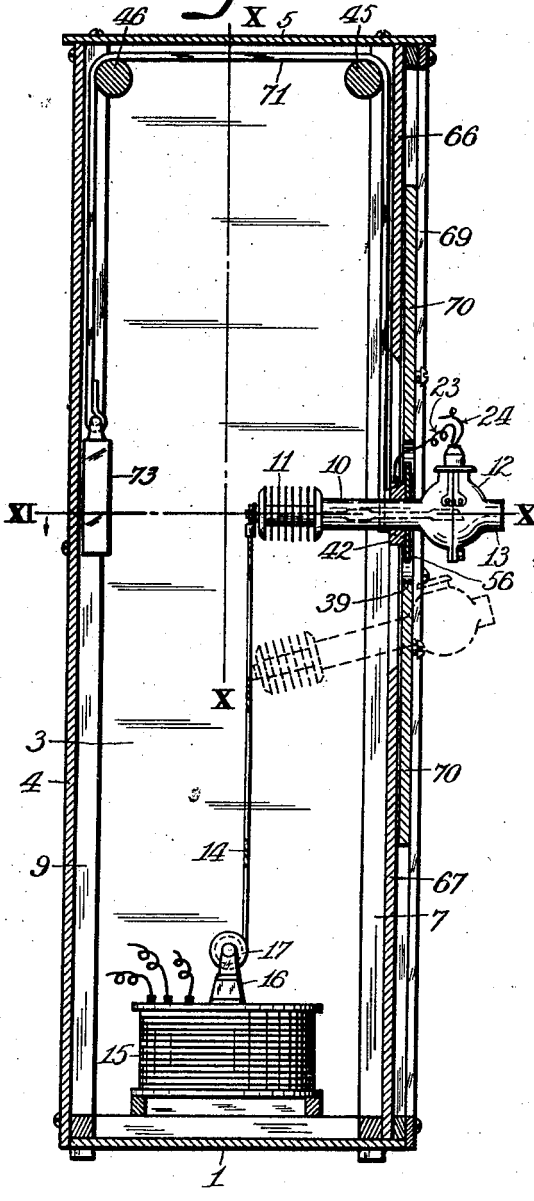


Fig. 10.

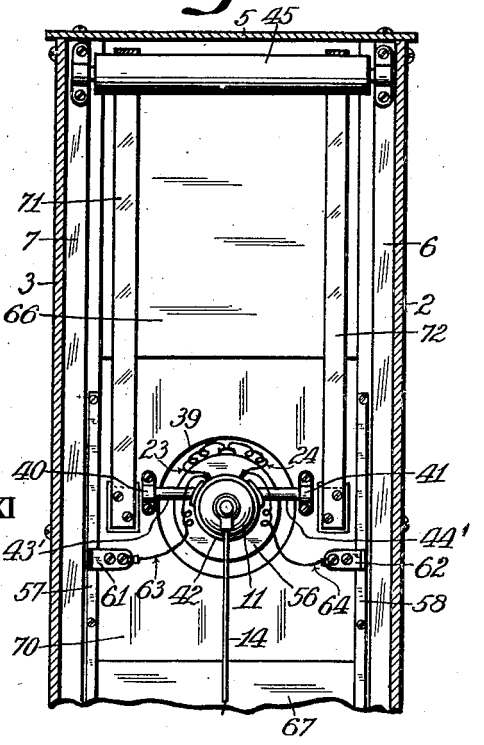
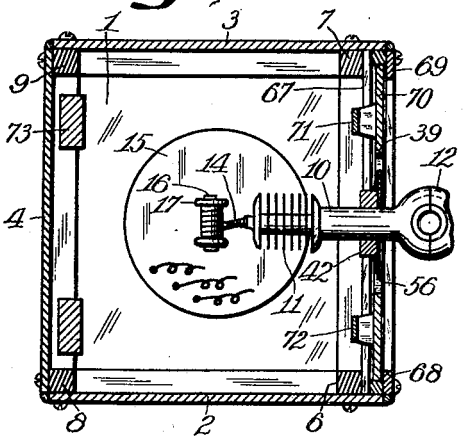


Fig. 11.



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E. L. EDWARDS ET AL

SAFETY X-RAY APPARATUS

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Fig. 12.

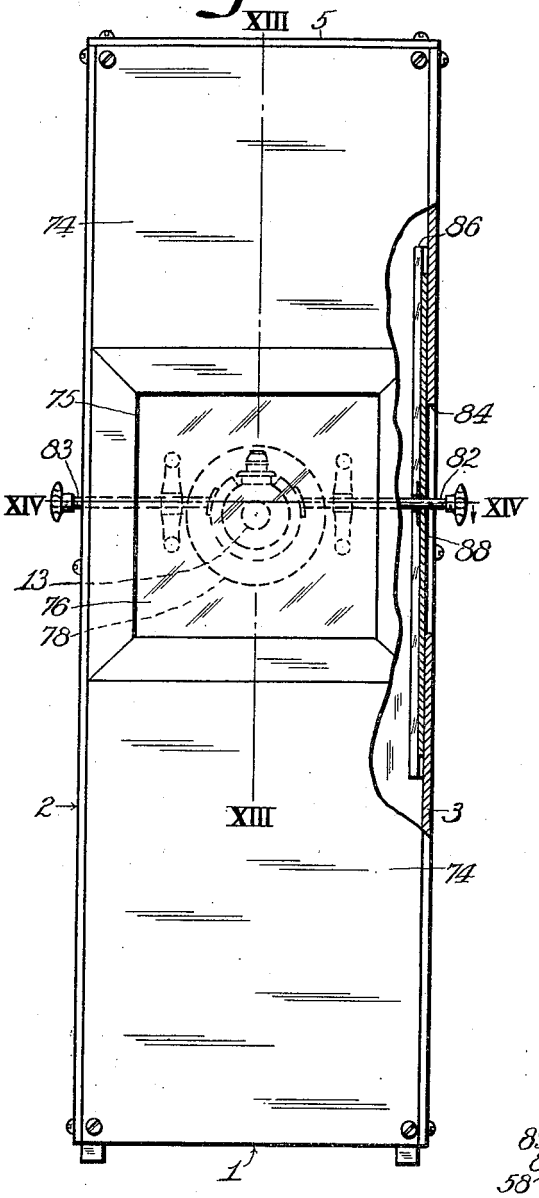


Fig. 13.

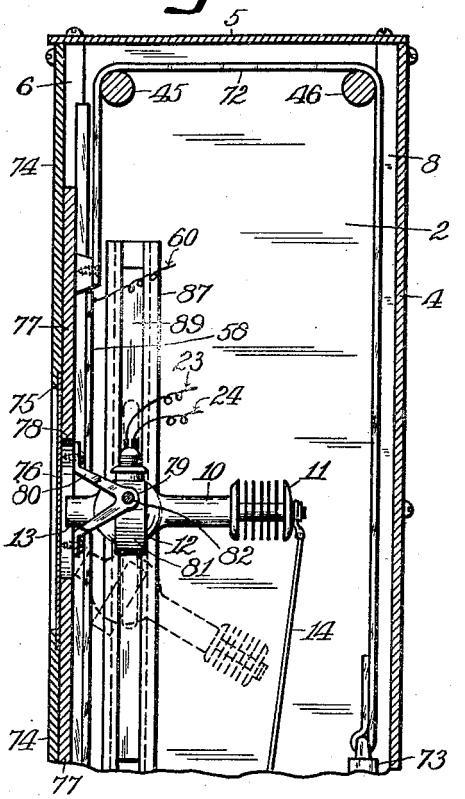
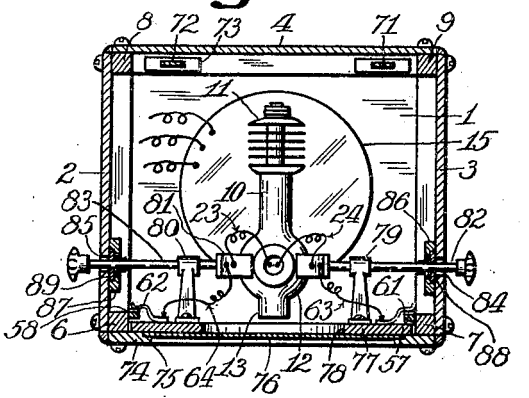


Fig. 14.



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SAFETY X-RAY APPARATUS

Filed Nov. 6, 1920 6 sheets-sheet 5

Fig. 15.

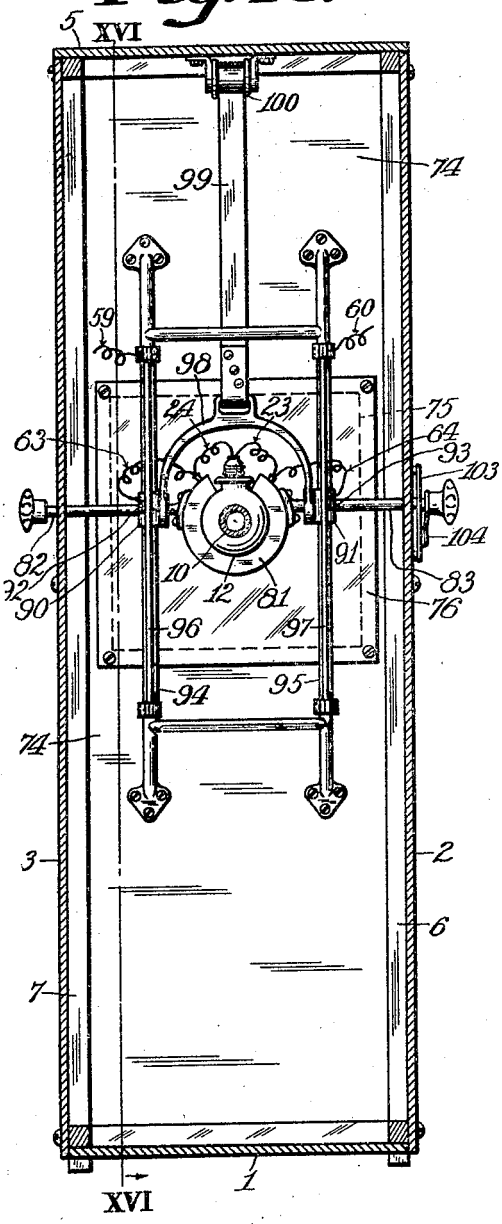
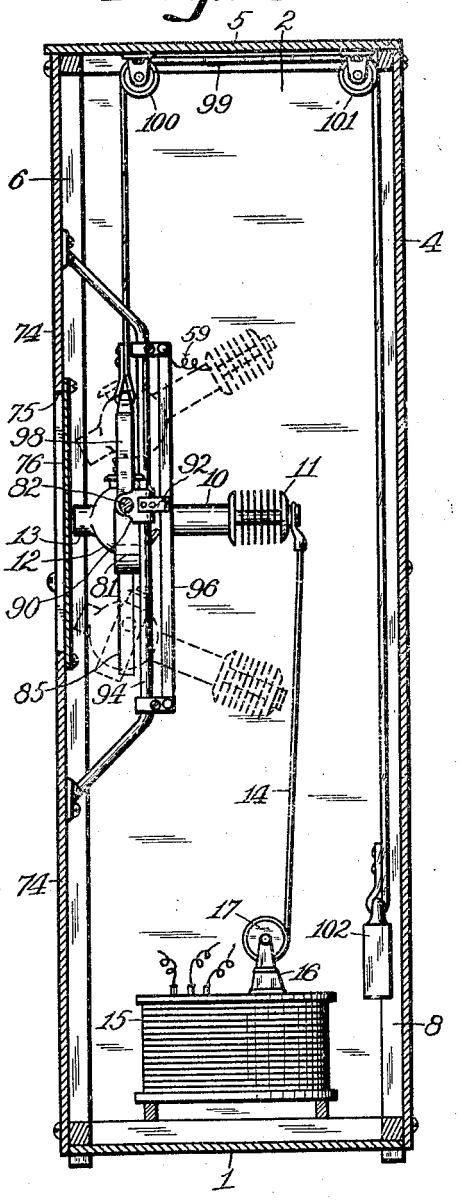


Fig. 16.



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SAFETY X-RAY APPARATUS

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Fig. 17.

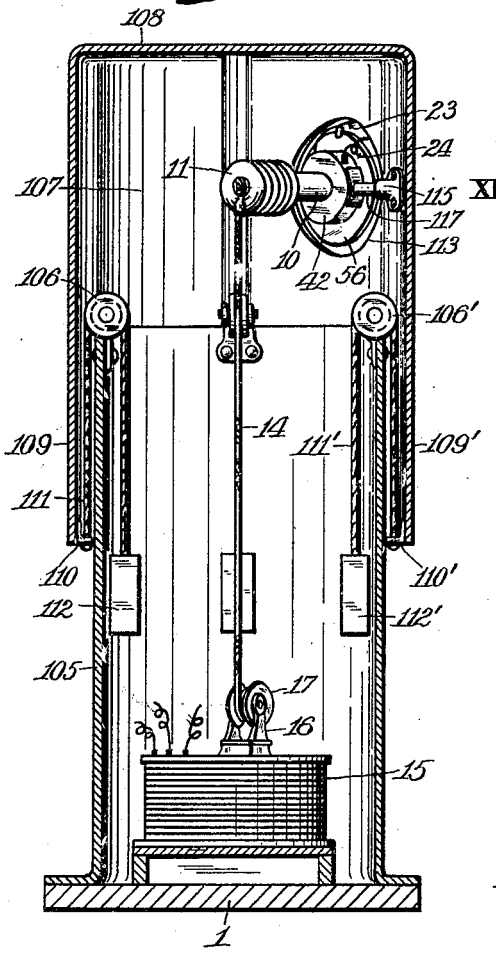


Fig. 18.

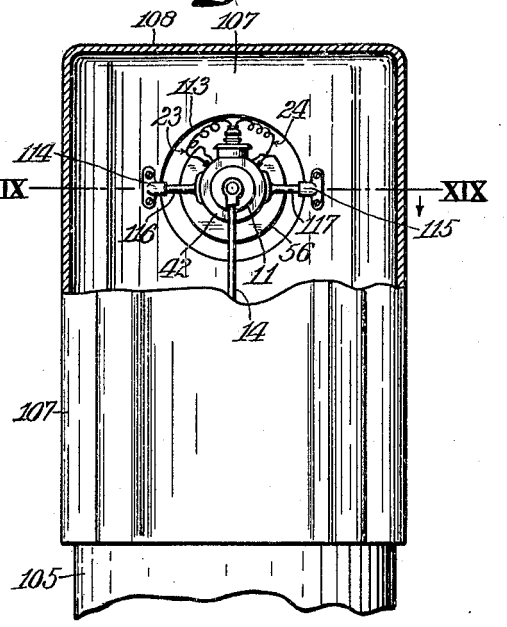
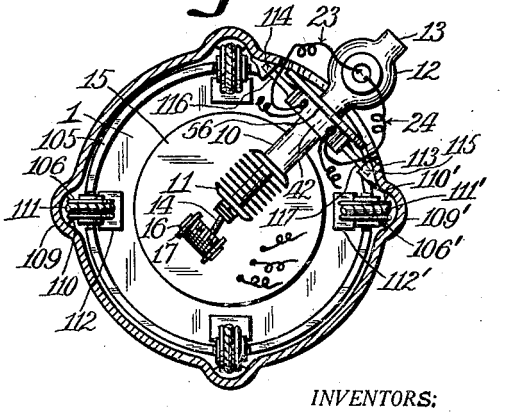


Fig. 19.



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Patented Mar. 27, 1923. 1,450,025

UNITED STATES PATENT OFFICE.

EDWIN L. EDWARDS AND FRANK A. FARWELL, OF INDIANAPOLIS, INDIANA, ASSIGNORS TO EDWARDS X-RAY CORPORATION, OF INDIANAPOLIS, INDIANA, A CORPORATION OF INDIANA.

SAFETY X-RAY APPARATUS.

Application filed November 6, 1920. Serial No. 422,145.

To all whom it may concern:

Be it known that we, EDWIN L. EDWARDS and FRANK A. FARWELL, citizens of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Safety X-Ray Apparatus, of which the following is a specification, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon.

This invention relates to an apparatus having an electrical circuit for conducting a current of very high voltage, such as an X-ray machine, the invention having reference more particularly to means whereby to adjustably support an X-ray tube, and to guard the high-tension electrical circuit required in the use thereof so as to permit the use of the apparatus safely in an operating room, where the operator or others might accidentally or carelessly have contact with the circuit or elements of the apparatus charged with high-tension current, with serious results.

An object of the invention is to provide a safety X-ray apparatus which shall be so constructed as to be adapted to inclose or guard a high-tension transformer and also a high-tension electrical circuit and the portion of an X-ray tube with which the circuit is connected, and to adjustably support the X-ray tube, in order to prevent an operator or other person from unintentionally receiving a shock by the dangerously high voltage required by the X-ray apparatus.

Another object is to provide an X-ray apparatus with a cabinet stand which shall be adapted to adjustably support an X-ray tube and also support a high-tension transformer so that the high-tension circuit required shall be inclosed and isolated by space and securely guarded, to prevent accidental or inadvertent contact of a person with the circuit.

A further object is to provide an improved X-ray apparatus which shall be so constructed as to safely inclose all the elements of the apparatus which might become charged with high voltage electrical current, and adjustably support an X-ray tube conveniently to a person in seated position, and permit the X-ray tube to be used at different angles.

A still further object is to provide a simple and substantial X-ray apparatus having a supporting casing for the required X-ray tube and various electrical devices, the casing being required to adjustably support the X-ray tube and inclose the required high-tension circuit in such manner that various instruments associated with the X-ray tube shall not be liable to become charged by high voltage current, but may be sufficiently inclosed within the casing to safeguard against accidents, which inclosing casing shall be designed to be variously modified as to details of construction, and be durable and economical in use.

With the above-mentioned and other objects in view, the invention consists in high-tension electrical apparatus having safeguards against injury to persons by high-tension currents by inclosing the apparatus and precluding the possibility of accidental contact therewith, and without requiring expensive and troublesome electrically insulating material, and the invention consists also further in novel means for adjustably supporting an X-ray tube and inclosing a high-tension electrical circuit associated therewith, and in the parts and combinations and arrangements of parts or elements as hereinafter particularly described and further defined in the accompanying claims.

Referring to the drawings, Figure 1 is a front elevation of the safety X-ray apparatus as preferably constructed; Fig. 2 is a vertical sectional elevation approximately on the line II—II on Fig. 1; Fig. 3 is a sectional elevation approximately on the line III—III in Fig. 2; Fig. 4 is a horizontal section approximately on the line IV—IV on Fig. 3; Fig. 5 is a fragmentary section approximately on the line V—V in Fig. 3 on an enlarged scale; Fig. 6 is a fragmentary sectional detail on the line VI—VI in Fig. 3 on an enlarged scale; Fig. 7 is a fragmentary front view of the apparatus with a portion thereof omitted;

Fig. 8 is a fragmentary section on the line VIII—VIII in Fig. 3 on an enlarged scale; Fig. 9 is a vertical sectional elevation approximately central of the apparatus slightly modified as to the supporting casing; Fig. 10 is a fragmentary sectional elevation approximately on the line X—X in Fig. 9; Fig. 11 is a horizontal section on the line XI—XI in Fig. 9; Fig. 12 is a front elevation, partially in section, illustrating another modification of the apparatus; Fig. 13 is a fragmentary sectional elevation approximately on the line XIII—XIII on Fig. 12; Fig. 14 is a horizontal section approximately on the line XIV—XIV on Fig. 12; Fig. 15 is a sectional elevation of another modified form of the apparatus, being approximately central of the supporting casing; Fig. 16 is a sectional elevation approximately on the line XVI—XVI in Fig. 15; Fig. 17 is a sectional elevation approximately central of still another modified form of the apparatus, more especially with reference to the supporting casing thereof; Fig. 18 is a fragmentary sectionad elevation showing a portion of the exterior of the modified casing; and, Fig. 19 is a horizontal section approximately on the line XIX—XIX in Fig. 18.

Similar reference characters in the various figures of the drawings indicate corresponding elements or features of construction or equivalents thereof hereinafter referred to or particularly described in detail.

In a practical embodiment of the invention a supporting casing or stand is provided which is adapted to not only safely inclose a high-tension transformer, but to adjustably support an X-ray tube of modern design in such manner that the necessary high-tension circuit and the rearward portion of the X-ray tube with which the circuit is connected shall be safely isolated by space from the wall of the casing, and also from various instruments commonly associated with an X-ray tube. The inclosing casing or stand may be variously constructed, a number of forms of structure being illustrated as sufficient to a full understanding of the invention. Each casing has a suitable bottom 1, and in accordance with the preferred form of construction the casing is rectangular in plan and has two side panels 2 and 3, a rear or back panel 4, and a top 5, all secured together and to the bottom, preferably by means of four corner posts 6, 7, 8, 9, such being substantially alike in the different modifications, excepting as hereinafter described, but the front portion especially of the casing may be variously constructed within the scope of the invention.

The X-ray tube preferably associated with the invention comprises a cylindrical stem 10 on the rear end of which is a radiator 11 and on the forward end of which is a bulb or head portion 12 having a forward neck 13 commonly composed of glass and lead combined. A high-tension electrical circuit or conductor 14 is suitably connected with the X-ray tube, usually at the end of the radiator. A step-up high-tension transformer 15 is suitably supported upon the bottom 1 and has a suitable frame 16 thereon supporting a reel 17 of well-known design with which the circuit 14, which is flexible, is connected, the circuit being suitably continued and connected with the transformer through the reel and the frame 16, as will be understood. Supply circuit wires 18 and 19 are connected with the transformer and extend through the wall of the casing, one of the circuit wires having a main supply line switch 20. Other circuit wires 21 and 22 are connected with the wires 18 and 19 respectively to supply current through low-tension circuit wires 23 and 24 suitably extending into the bulb 12 of the X-ray tube for a well-known purpose.

The various forms of structure of the casing may each support various electrical instruments as may be desired in association with the X-ray tube, such as an "auto" transformer 25, an X-ray switch 26 symbolically illustrated but which may be outside the casing, a filament switch 27, a solenoid controller 28, a filament controller 29, a filament transformer 30, a resistance coil 31, an automatic switch 32, and a milli-ammeter 33, the various instruments being well-known and are indicated as being incased.

According to the preferred form of construction as shown in Figs. 1 to 8, inclusive, the front of the inclosing casing has external vertical guides 34 and 35 and adjacent internal guides 36 and 37, and an adjustable panel 38 is vertically guided by the guides and has an aperture 39 therein. Two journal bearings 40 and 41 are secured to the inner side of the panel 38 to adjustably support the X-ray tube which has a suitable yoke or collar 42 secured thereto, preferably on the stem portion 10 thereof. Two shafts 43 and 44 are secured to the yoke or collar and are rotatably supported in the journal bearings, the shafts preferably extending through the side panels of the casing and having suitable handles on their ends whereby to turn the shafts, the side panels being suitably slotted to permit the shafts to be moved upward or downward. Thus supported the stem 10 extends through the aperture 39. A roller 45 is mounted in the upper forward portion and a similar roller 46 is mounted in the upper rearward portion of the casing, and rollers 47 and 48 are similarly arranged in the lower portion of the casing. Two belts 49 and 50 are secured to the upper portion of the panel 38 and extend over the upper rollers and downward adjacent to the back of the casing, and a

counter-balancing weight 51. is secured to the belts. Two belts 52 and 53 are secured to the lower portion of the panel 38 and extend under the lower rollers and upward to the weight 51 to which they are secured. The upper portion of the front of the casing is closed by a flexible panel or blind 54 composed of slats secured to the belts 49 and 50 and arranged to be guided on a vertical plane with the panel 38, the flexible panel extending under the top 5 of the casing. Another flexible panel composed of slats 55 secured to the belts 52 and 53 extends from the panel 38 downward to and under the roller 47 to close the lower portion of the front of the casing. The aperture 39 permits the X-ray tube to be tilted, and to prevent over-curious persons from inserting a hand through the aperture 39 and becoming shocked by high-tension current; a guard plate 56 is arranged in the aperture and secured to the yoke 42. The X-ray tube is so arranged that the high-tension circuit 14 extends directly upward from the reel 17 to the rearward end of the stem 10 at a safe distance from all portions of the casing wall so as to be isolated by space from the wall, and obviate the necessity of providing the casing wall with electrically insulating lining.

Devices for completing a low-voltage circuit with the wires 23 and 24 may be variously constructed, a pair of brush-contact bars or rods 57 and 58 preferably being supported on the interior guides 36 and 37 respectively and having circuit wires 59 and 60 connected thereto respectively, the wires being suitably connected with the supply circuit. Electrical brushes 61 and 62 are suitably mounted on the inner side of the panel 38 in contact with the bars or rods 57 and 58 respectively and have circuit wires 63 and 64 connected therewith that suitably lead to the wires 24 and 23 respectively.

The front of the X-ray tube preferably is screened, and when the X-ray tube projects through the front of the casing as shown a cap-shaped filtering screen 65 composed of suitable material may be secured to the front of the panel 38 so as to cover the forward portion of the X-ray tube, the front of the screen preferably being semi-transparent or transparent to permit the neck 13 to be seen through the screen. The screen may be removed when desired. Incidentally it serves the useful purpose of excluding dust from the apparatus. When the inflexible panel 38 is raised or lowered to adjust the X-ray tube the flexible panels are moved in unison and always afford closure for the front of the casing.

Constructed as indicated in Figs. 9, 10 and 11, the front of the casing has a fixed panel 66 closing the upper portion and a fixed panel 67 closing the lower portion of the casing front, and forward of the panels two guides 68 and 69 are suitably supported and guide an adjustable panel 70 which has the aperture 39 therein. The upper portion of the casing has the guide rollers 45 and 46 therein, as above described, and belts 71 and 72 are suitably connected to the panel 70 and extend over the rollers, and the belts have counterbalancing weights 73 thereon. The inner side of the panel 70 is provided with the journal bearings 40 and 41 which rotatively support shafts 43′ and 44′ respectively that are secured to the yoke or collar 42 on the X-ray tube, the guard plate 56 being secured to the yoke or collar 42. The space between the panels 66 and 67 permits vertical movement of the X-ray tube with which the high-tension circuit 14 is connected. This modification permits the circuit to be made with the wires 23 and 24 as above described. The screen is omitted but obviously may be connected to the panel 70, as above described, and in some cases the screen may be omitted in practice, permitting the X-ray tube to be tilted adjustably directly by hand. But it should be understood that provision may be made as above described for tilting the X-ray tube by means of its supporting shafts or pivotal devices.

The apparatus shown in Figs. 12, 13 and 14 is mainly constructed as above described but the supporting casing has a single fixed front panel 74 in which is an aperture 75 closed by a suitable screen 76 secured to the panel. A firm panel or slide 77 is arranged behind the panel 74 and preferably has an aperture 78 therein, the slide being suitably guided for vertical adjustment and provided on its inner side with journal bearing brackets 79 and 80. The bulb portion 12 of the X-ray tube is provided with a supporting yoke 81 which has shafts 82 and 83 secured thereto that are rotatably supported in the brackets so that the neck 13 of the X-ray tube is back of the screen 76. The side panels 3 and 2 have vertical slots 84 and 85 through which the shafts extend, and the panels are provided with guides 86 and 87 at the slots respectively in which slot-closing plates 88 and 89 are guided respectively and connected with the adjacent shafts. The electrical device may be arranged and connected in the casing as above described, and the panel or slide 77 and the X-ray tube is counter-balanced as above described.

In the modification shown in Figs. 15 and 16 the casing has the single front panel 74 having the aperture 75 closed by the screen 76. Instead of supporting the X-ray tube on an adjustable front panel the pivotal shafts 82 and 83 are mounted in adjustable journal boxes 90 and 91 respectively which carry electrical brushes 92 and 93 respectively to which the wires 63 and 64 are connected respectively. Two guide bars 94 and

95 are vertically supported on the inner side of the front panel 74 and suitably support two brush-contact bars or rods 96 and 97 respectively so as to be in contact with the brushes, the bars or rods having the wires 59 and 60 connected thereto respectively. A forked hanger 98 rotatively supports the shafts 82 and 83 and is connected to a belt 99 that extends over two pulleys 100 and 101 supported under the top 5 of the casing, the end of the belt having a counter-weight 102 thereon. The side panels of the casing have vertical slots through which the shafts extend. One of the shafts may have a suitable indicator plate 103 hanging thereon adjacent to the outer side of the panel and the adjacent shaft may have an indicator pointer 104 fixed thereto, to indicate the angular tilt of the X-ray tube which in some cases may not be visible to the operator.

When a cylindrical supporting casing is desired, in order to eliminate angular corners, a hollow cylindrical wall 105 is vertically arranged upon and secured to a suitable bottom 1, and a suitable number of guide sheaves 106, 106′ are mounted on the upper portion of the wall. The casing is required to adjustably support the X-ray tube and preferably the entire upper portion of the casing is vertically adjustable, being preferably composed of a cylindrical shell 107 having a top 108, the shell being adapted to slip over and be guided on the wall 105 and having flutes 109, 109′ to receive the sheaves. Lugs 110, 110′ are secured to the shell in the flutes and cables 111, 111′ are secured to the lugs and extend upward in the flutes and over the sheaves, counter-weights 112, 112′ being connected to the ends of the cables respectively. The shell 107 has an aperture 113 therein, and journal bearings 114 and 115 are secured to the inner side of the shell adjacent to the aperture and rotatively support pivotal shafts 116 and 117 respectively that are secured to the yoke or collar 42 on the X-ray tube. The transformer 15 is centrally supported on the bottom 1, so that the high-tension circuit 14 extends upward nearly along the vertical axis of the casing to the rear end of the X-ray tube.

In practical use the operator readily raises or lowers the X-ray tube or pivotally tilts it to different angles, as may be desired or required to obtain the best results, the reel 17 always taking up or letting out portions of the high-tension circuit 14 so that it shall not become slack but shall be kept at a safe distance from the casing wall. A well-known attachment may be applied to the neck 13 of the X-ray tube. The dangerously charged portion of the X-ray tube is inaccessible from the outside of the casing and consequently is not a source of danger to a careless operator or to attendants or others, and accidental injury to the X-ray tube is prevented by the use of the screen.

Having thus described the invention, what is claimed as new is—

1. An X-ray apparatus including a supporting casing comprising a front and a back and also sides, a roller arranged immediately adjacent to the upper portion of said front, a roller arranged immediately adjacent to the upper portion of said back, a belt extending over the rollers and also downward immediately adjacent to said front and said back, an X-ray tube having support on the belt adjacent to said front, the support enabling the tube to be tilted, and a counter-balance weight arranged adjacent to said back and connected to said belt.

2. An X-ray apparatus including a closed supporting casing, a high-tension electrical transformer supported centrally in the lower portion of the casing, a reel supported on the top of the transformer, an X-ray tube tiltably supported by the casing above the transformer and the reel and for adjustment relatively to the bottom of the casing, there being a radiator connected with the tube, and a high-tension electrical conductor wound on the reel and extending through clear space within the casing directly to the radiator and the X-ray tube and connected therewith.

3. An X-ray apparatus including a closed supporting casing, a vertically-adjustable guided device in the casing with a counter-balance, a yoke pivotally supported by the guided device, an X-ray tube embraced by and secured to the yoke, there being a radiator on the rearward portion of the tube, the radiator being located above the lower central portion of the casing, a transformer within the lower central portion of the supporting casing, and a high-tension electrical conductor having connection with the transformer and extending upward and to the rearward portion of the X-ray tube and connected with and supported thereby adjacent to said radiator.

4. An X-ray apparatus including a supporting casing comprising a front and sides and also a bottom and a top, the front movably supporting two journal bearings, a yoke having two shafts rotatively supported in said bearings, an X-ray tube secured to the yoke with the rearward end of the tube projecting away from said front beyond the yoke and equi-distant from said sides, rollers supported below said top, a belt extending over the rollers and operatively connected with said bearings, a weight connected to the belt, a transformer supported upon said bottom, and a high-tension electrical conductor having connection with the transformer and extending to the rearward end of the X-ray tube and supported thereby.

5. In an X-ray apparatus, the combina-

tion of a supporting casing comprising inclosing wall portions having a front wall comprising a vertically-adjustable panel and two flexible blinds connected to the adjustable panel to be adjusted thereby, and guides for the blinds; and an X-ray tube mounted on the vertically-adjustable panel.

6. In an X-ray apparatus, the combination of a stationary casing part, rollers supported by the stationary casing part, belts extending over the rollers, and weights permanently connected to the belts, with a vertically-movable casing part guided by the stationary casing part and connected with the belts, an X-ray tube pivotally supported on the movable casing part, a transformer arranged below the X-ray tube in the stationary casing part, and a flexible high-tension electrical conductor suspended on the X-ray tube and having connection with the transformer.

7. In an X-ray apparatus, the combination with a supporting casing comprising upright side panels, of an upper front panel portion connected with the upper portions of the side panels, a lower front panel portion connected with the lower portion of the side panels, a vertically-adjustable panel guided adjacent to the said front panel portions, a yoke pivotally supported on the vertically-adjustable panel, an X-ray tube embraced by and secured to the yoke, said tube including a stem having a radiator on its end, and a high-tension electrical conductor connected with and supported by the radiator on the stem of the X-ray tube.

8. In an X-ray apparatus, the combination of a casing part having a relatively adjustable part guided thereby, the adjustable part having an aperture therein, an X-ray tube arranged mainly outside the adjustable part and comprising a housing having a stem extending through and inwardly away from the aperture, there being a radiator on the end of the stem, a yoke secured to said housing and pivotally supported on the inside of said adjustable part adjacent to said aperture, a transformer supported in the casing main part below said radiator, and a flexible high-tension electrical conductor connected with the X-ray tube adjacent to said radiator and having connection with the transformer.

9. In an X-ray apparatus, the combination of a supporting casing comprising two side panels, a back panel, a top, and an adjustable front panel vertically guided adjacent to the side panels and having an aperture therein; a yoke pivotally supported on the inner side of the said front panel, an X-ray tube with a stem extending through said aperture and embraced by and secured to the yoke, said tube having a relatively large bulb on the stem supported beyond the outer side of said front panel, flexible low-tension circuit wires extending out through said aperture to said bulb, two rollers mounted adjacent to said top, a flexible high-tension electrical conductor connected with the inner end of said stem, a belt connected with said front panel and extending over said rollers and nearly to said back panel, and a weight connected to said belt adjacent to said back panel.

10. In an X-ray apparatus, the combination of a supporting casing comprising a bottom, two side panels, a back panel, a top, two low rollers mounted adjacent to the forward and rearward ends respectively of said bottom, two high rollers mounted adjacent to the forward and rearward portions respectively of said top, an adjustable front panel vertically guided adjacent to said side panels, a flexible blind connected to the upper portion of the adjustable panel and extending over said high rollers, a counterweight connected to said blind, and a flexible blind connected to the lower portion of the adjustable panel and extending under said low rollers towards said back panels and connected to said counter-weight; and an X-ray tube mounted on the adjustable front panel.

11. In an X-ray apparatus, the combination with an X-ray tube of the type comprising a bulb having a short front neck on one side and a relatively long stem on the opposite side thereof, and a radiator on the end of the stem; of an upright casing tiltingly supporting the X-ray tube with the radiator approximately on the vertical axis of the casing and permitting upward or downward movement of the radiator, a transformer arranged in the casing below said radiator, a take-up reel arranged upon the top of the transformer, a flexible high-tension electrical conductor extending from the reel upward to the radiator and connected therewith, the conductor being bodily supported and drawn upward by the radiator, and flexible low-tension electrical circuit wires connected with the bulb of the X-ray tube and having support within the casing.

12. In an X-ray apparatus, the combination with a supporting and inclosing casing having an aperture in one portion thereof, and a transformer in the lower portion of the casing, of a yoke pivotally and adjustably supported on the inside of the casing, an X-ray tube extending through said aperture and said yoke and being secured to the yoke, the X-ray tube being of the type comprising a bulb having a short front neck on one side and a relatively long stem on the opposite side thereof and a radiator on the end of the stem, said bulb and front neck being arranged outside the casing and said

stem arranged inside the casing, a flexible high-tension electrical conductor connected with the X-ray tube and extending from the end of said stem to the transformer, a counterbalance for the X-ray tube, and flexible low-tension circuit wires having support within the casing and extending into said bulb to the X-ray tube.

In testimony whereof, we affix our signatures in presence of two witnesses.

EDWIN L. EDWARDS.
FRANK A. FARWELL.

Witnesses:
E. T. SILVIUS,
H. L. ARCHER.

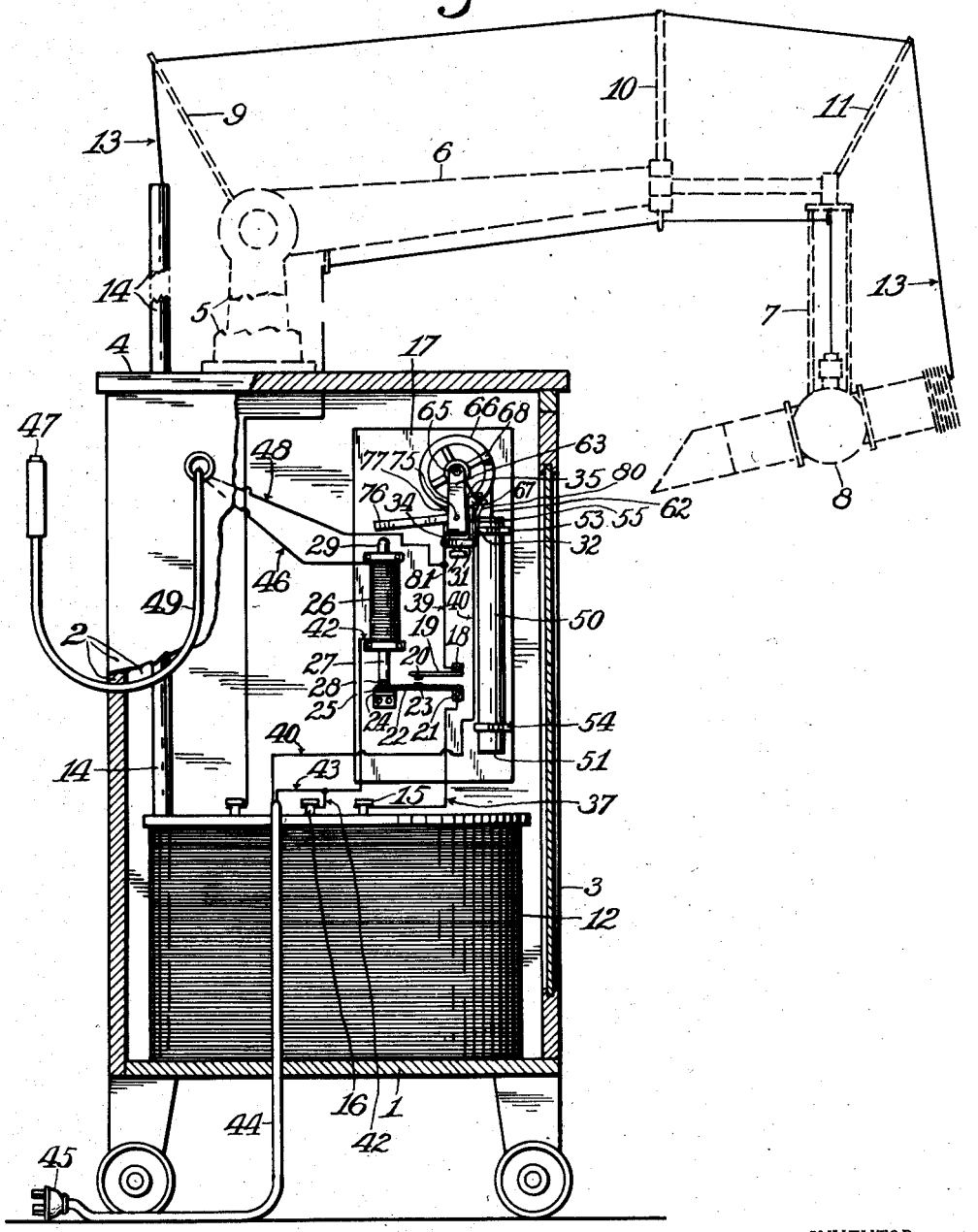
April 22 , 1924. 1,491,591

E. L. EDWARDS

TIME SWITCH FOR ELECTRICAL CIRCUITS

Filed July 15 , 1920 2 Sheets-Sheet 1

Fig. 1.



WITNESS:

Ed J. Clark.

R. H. Sample.

INVENTOR:

Edwin L. Edwards,

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ATTORNEY.

April 22, 1924. 1,491,591

E. L. EDWARDS

TIME SWITCH FOR ELECTRICAL CIRCUITS

Filed July 15, 1920 2 Sheets-Sheet 2

Fig. 2.

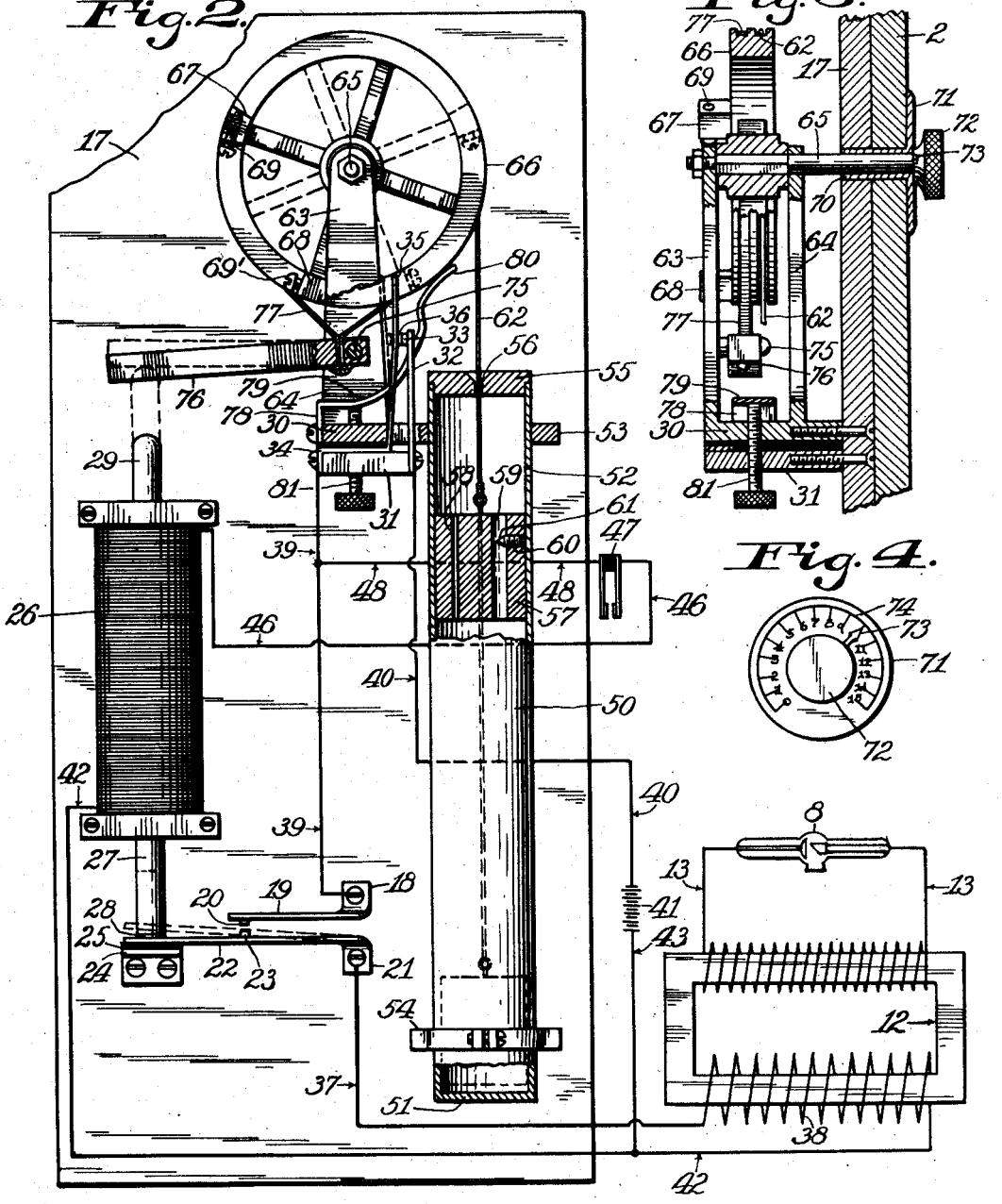

Fig. 5.

Fig. 4.

WITNESS:

Ed J. Clark.

R. H. Sample.

INVENTOR:

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BY

E. T. Silvius,

ATTORNEY.

Patented Apr. 22, 1924. 1,491,591

UNITED STATES PATENT OFFICE.

EDWIN L. EDWARDS, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO EDWARDS X-RAY CORPORATION, OF INDIANAPOLIS, INDIANA, A CORPORATION OF INDIANA.

TIME SWITCH FOR ELECTRICAL CIRCUITS.

Application filed July 15, 1920. Serial No. 396,560.

To all whom it may concern:

Be it known that I, EDWIN L. EDWARDS, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Time Switch for Electrical Circuits, of which the following is a specification, reference being had to the accompanying drawings and to the letters and figures of reference marked thereon.

This invention relates to means for automatically breaking an electrical current after the circuit has been established, the invention having reference more particularly to a time switch that is designed to be used in connection with an X-ray apparatus, for automatically breaking the electrical circuit required for operation of the X-ray tube.

An object of the invention is to provide an efficient and reliable time switch which shall be adapted to operate to eliminate trouble of possibly serious nature which might result from continuance of the use of electric current beyond a definite period of time.

Another object is to enable operators of X-ray apparatus to avoid serious consequences due to over-exposure to the X-ray; the purpose more specifically being to provide apparatus to control an electrical circuit so that the circuit shall be instantly broken after a definite period of time, without depending upon the operator to break the circuit when he may be engaged in making observations or directing operations and unintentionally prove to be unreliable as a timer.

A still further object is to provide improved apparatus whereby the period of action of an electrical force may be accurately timed or measured, and the current automatically switched off at the end of the period of time desired, more particularly to time the use of high-tension current when failure of the operator to turn off the current at the proper time might result in serious consequences.

With the above-mentioned and other objects in view, the invention consists in an electrical control system involving high-tension current, the switching on of the current, and the timing and automatic switching off of the current after having been used during a definite period of time; and, the invention consists also further in an improved timing device and in the features or parts and combinations and arrangements thereof, as hereinafter particularly described and further defined in the accompanying claims.

Referring to the drawings,—Figure 1 is a vertical sectional elevation of an X-ray apparatus, including an X-ray tube and its holder shown by broken lines, and the time switch as preferably constructed and arranged; Fig. 2 is an elevation of the time switch on an enlarged scale as preferably constructed, portions being broken away, and a diagram of the electrical system involved; Fig. 3 is a fragmentary transverse section showing details of portions of the preceding figure; and Fig. 4 is a plan of a timing indicator of preferable form.

Similar reference characters in the various figures of the drawings indicate corresponding elements or features of construction herein referred to in detail.

For the purpose of clearly explaining the invention and its importance in one of the useful and advantageous applications thereof, so much of an X-ray apparatus as may be associated with the invention is shown in the drawings and comprises a cabinet which has a bottom 1, a side wall 2 provided with a door 3, and a top 4; and by broken lines is illustrated a crane-like holder comprising a column 5, on the top of the cabinet and having an arm 6, provided with suitable hangers 7, supporting an X-ray tube 8, the arm having posts 9, 10 and 11 thereon to support a circuit wire. A transformer 12 is arranged on the bottom of the cabinet, and a high tension circuit 13 leads from the transformer over the posts to the X-ray tube, usually through a protecting guide tube 14, the transformer commonly having binding posts 15 and 16 for readily connecting circuit wires with the transformer.

The time switch, or electrical circuit breaker, preferably is mounted as a unit on a suitable base 17, which may be wooden or composed of non-conducting material and arranged on the side wall 2 of the cabinet. A base plate 18 is fixedly mounted on the base 17, and supports a switch bar 19, having a suitable contact point 20. Another base plate 21 is mounted also on the base 17 and supports an elastic switch arm 22 which extends under and beyond the bar 19 and has a contact point 23 opposite to the point 20 and held in contact therewith when the

switch arm is not forced from the switch bar to a stop bracket 24, mounted on the base 17 and in some cases having an insulator 25 upon which the switch arm may rest. A solenoid 26 is suitably arranged on the base 17 above the stop bracket 24 and its armature 27 preferably is cylindrical, and being vertically arranged its lower end may hold the switch arm 22 to the stop bracket 24, the armature preferably having an insulating lower end 28. The armature has a projection 29 on its upper portion that extends upward beyond the main portion of the solenoid. A bracket 30 is secured to the base 17 and beneath the bracket a switch base 31 is suitably supported and may be a non-conducter or provided, as may be required, with insulation. The switch base supports a switch bar 32 preferably having a suitable contact point 33. A switch plate 34 is secured to the switch base and supports an elastic switch arm 35 opposite to the bar 32 and having a contact point 36 which is held by the switch arm in contact with the point 33, being designed for breaking or opening the circuit at the end of a definite period. A circuit wire 37 is connected with one end of the primary coil 38 of the transformer and with the base plate 21. A circuit wire 39 is connected with the base plate 18 and also with the switch plate 34. A circuit wire 40 is connected with the switch bar 32 and also with a suitable battery or source of electrical energy 41 with which a circuit wire 42 is also connected by means of a branch 43, the wire 42 being connected with the opposite end of the primary coil 38 and also with one end of the winding of the solenoid 26. The wires 40 and 43 in practice may be arranged in a cable or casing 44 extending outside of the cabinet and provided with a suitable connector 45 whereby to connect the circuit wires with a current supply circuit. A circuit wire 46 is connected with the opposite end of the solenoid winding and also with a suitable switch 47, another circuit wire 48 being connected with the switch and also with the circuit wire 39. In the drawings the switch is symbolically illustrated, but in practice as seen in Fig. 1 the switch wires 46 and 48 are arranged in a cable or casing 49, extending through the cabinet wall and having the switch connected therewith outside the cabinet.

The timing device preferably comprises a hollow cylinder 50 which is vertically arranged and has a bottom 51, and at a suitable distance from the top of the cylinder its wall has a small aperture 52 to permit the cylinder to be supplied with a suitable liquid or to permit the liquid to be readily replenished as required. The cylinder is secured to the base 17 by suitable clamps 53 and 54 permitting vertical adjustment of the cylinder if desired. The top portion of the cylinder has a head 55 thereon, in which is a central aperture 56. A heavy piston 57 is arranged in the cylinder to freely slide while being closely fitted so as not to require packing, the piston being designed to descend by the force of gravity. The cylinder is usually supplied with water which tends to cause uniform speed of the descending piston, which has a vertical channel 58 and in some cases a second channel 59 to permit the water to pass through the piston. Preferably a screw plug 60 is inserted in the wall of the piston and extending to one of the channels and having a conical valve point 61 which is designed for choking the channel more or less as may be desired. A flexible cable or cord 62 is connected to the piston and extends through the head 55 for lifting the piston and assisting in controlling the descent of the piston.

As a preferred means for control of the piston, the bracket 30 has standards 63 and 64 thereon, in which a shaft 65 is rotatively mounted, and extending through the base 17 and the side wall 2 of the cabinet. A grooved wheel 66 is secured to the shaft and has two stop blocks 67 and 68 on one side thereof to be moved into contact with opposite sides respectively of the standards, these stop blocks preferably having adjusting screws 69 and 69′ that may be projected from the stop blocks to vary the extent of movement of the wheel. The cable 62 is secured in one of the grooves of the wheel to enable the wheel to partially wind up the cable or to unwind it. A journal box 70 is arranged in the wall 2 of the cabinet and assists in supporting the shaft 65 which is designed for winding up the cable 62 and to operate as an indicator spindle. The journal box has an indicator dial 71 fixed thereon, which is located on the outer side of the cabinet wall, and the shaft has a knob 72 fixed thereon, a pointer 73 being fixed to the knob to sweep the dial which has an indicator scale 74 thereon with which the pointer is designed to co-operate. The scale is suitably graduated and the graduations suitably numbered, as 1 to 15 inclusive, to indicate seconds of time, for instance.

A suitable lock is provided essentially for temporarily preventing the operation of the timing device until the moment when the measurement of the time should begin, and in the preferred construction one of the standards is provided with a pivot 75 to which a lever 76 is connected, being below the wheel 66, and the lever extends above the extension 29 of the solenoid armature to be lifted thereby, a brake band 77 being arranged in a groove of the wheel and connected to the lever, the arrangement being such as to enable the lever by reason of its weight and the force of gravity to tighten

the band on the wheel and lock the wheel against movement by the weight of the piston 57, but permitting the wheel to be forcibly rotated by means of the knob 72 to raise the piston.

For the purpose of assisting to regulate the speed of the piston 57 when descending so that the extent of movement of the wheel 66 shall be in accordance with the graduated dial or scale, a friction-brake preferably is provided and comprises a base member 78 secured to the bracket 30 and having an elastic arm 79 thereon, which has a contact shoe portion 80 arranged in contact with the periphery of the wheel 66. The tension of the arm 79 may be delicately adjusted by means of an adjusting screw 81 arranged in the bracket 30 and extending against the under side of the arm. In case the displacement of the liquid from beneath the piston through the piston does not insure the correct speed of the piston while descending, the tension of the brake may be adjusted to compensate for previous miscalculation in making adjustments or to compensate for differences in the character of liquid which may be used in the timing cylinder.

By reference to Fig. 2 it will be seen that the devices 19 and 22 which constitute an automatic circuit connector are normally apart so that the circuit is open when the manually operated starting switch 47 is open while the switch elements 32 and 35 constituting the circuit breaker are together so as to close the circuit which is to be automatically opened at the required time instead of depending upon the operator to open the switch 47 or permit the switch to open precisely at the proper time.

When the X-ray machines are produced in a factory they may be provided with such time switches as may be desired and of more or less costly design to suit the customer. It is preferable to ship the machine with the timer cylinder empty, to be supplied with a suitable liquid when the machine is set up for use at which time adjustments may be made as required. It should be understood adjustments may be made if desired to permit fairly accurate timing without the use of a liquid in the timing cylinder, in which case descent of the piston would be governed by air pressure beneath the piston, the channel in the piston permitting escape of air at uniform velocity. The indicator scale being fixed in the factory, usually to indicate a maximum period of 15 seconds of time, it should be understood that adjustments may be readily made by the operator to insure the breaking of the circuit at the end of a definite period, using the indicator as a basis for calculations.

In practical use, the circuit wires being in connection with a source of electricity, and it being desired to use the electrical current or force during a certain period of time, as for instance when an X-ray tube is used, the timer piston is manually caused to be drawn up in the cylinder until the starting point is indicated on the timing scale, the piston then being temporarily held by the lock or brake which is provided for the purpose. When the operator is ready to begin using the electrical current he manipulates the hand switch 47 to close the circuit, resulting in the solenoid being energized so that its armature causes the release of the lock or brake and at the same time causes or permits the establishment of the electrical circuit, which may be through the transformer, while the timing piston is permitted to descend in the timing cylinder at uniform speed. The starting point may be at any graduation mark desired on the indicator scale. In the operation of the structure the piston descends until the stop block 67 is carried around to the breaker switch arm 35 which is opposite to the standard 63, the arm being then engaged by the stop block and forced over to the standard with the result that the contact point 36 is separated from the contact point 33 and the circuit broken or opened. When the electrical circuit is broken or opened the solenoid becomes de-energized so that its armature is permitted to descend and cause the further breaking of the electrical circuit, by retracting the switch arm 22. The electrical circuit having been positively and accurately broken or opened at the end of the desired period of time, the operator may leisurely cause or permit the hand switch 47 to be opened, after which the apparatus remains dormant or inoperative until again required for use.

Having thus described the invention, what is claimed as new is—

1. An electrical circuit time switch including an upright hollow cylinder, a weighted piston movable in the cylinder, a rotary wheel and a cable to lift or to permit descent of the piston and provided with locking means therefor including a pivoted automatically-operating actuating lever, a brake operating on the wheel, a solenoid supported in proximity to and controlling the lever, and a circuit breaker controlled by the wheel.

2. An electrical circuit time switch including an upright hollow cylinder, a piston movable in the cylinder and having a channel extending therethrough, controlling means to lift or to permit descent of the piston including a rotatable wheel and a cable extending about and secured to the wheel and having connection with the piston, an electrical circuit breaker device, a solenoid and means controlled thereby to

control the wheel, and means controlled by the wheel to alternately break and make an electrical circuit with the breaker device.

3. An electrical circuit time switch including an upright hollow cylinder, a piston movable in the cylinder, a rotary wheel and a cable to lift or to permit descent of the piston, a supported solenoid having an armature with upper and lower extensions, locking means for the wheel including a pivoted automatically-operating actuating lever having an arm opposite to the upper armature extension to be controlled thereby, a brake operating on the wheel, a circuit connector controlled by the lower armature extension, and a circuit breaker controlled by the rotary wheel.

4. An electrical circuit time switch including an upright hollow cylinder, a piston movable in the cylinder and having a channel extending therethrough, controlling means to lift or to permit descent of the piston including a rotatable wheel and a cable extending about and secured to the wheel and having connection with the piston, a brake operating on the wheel, a supported solenoid having an armature with an extension, a circuit connector controlled by the armature extension, an electrical circuit breaker device, and means controlled by the wheel to alternatively break and make an electrical circuit with the breaker device.

5. An electrical circuit time switch including a vertical rotary wheel having a block on one vertical side thereof, a vertical hollow cylinder arranged lower than the wheel, a supported switch bar arranged in proximity to the wheel, a piston movable in the cylinder, a cable connected with the piston and extending over the periphery of the wheel and secured thereto, a brake operating on the wheel, a supported elastic switch arm having electrical connection with the switch bar and extending into the path of movement of the block on the wheel to be moved and held thereby from connection with the switch bar, and means to limit the rotary movement of the wheel.

6. An electrical circuit time switch including a hollow stationary vertical cylinder, a piston movable in the cylinder, a rotatably supported wheel having a horizontal axle fixed thereto, a cable connected to the piston and the periphery of the wheel enabling the wheel to lift the piston, means connected to said axle to rotate the wheel in one direction to lift the piston, friction-hold locking means operating on the wheel to prevent descent of the piston with rotation of the wheel in the opposite direction, an electrical circuit breaker device, and means controlled by the wheel to alternately break and make an electrical circuit with the breaker device, with means to graduatedly retard rotation of the wheel.

7. An electrical circuit time switch comprising a supported standard, a supported switch bar extending opposite to the standard, a supported elastic switch arm extending between the standard and the switch bar and beyond the end of the bar, the arm having electrical connection with the bar, a wheel rotatively mounted on the standard and having a block on one side thereof to engage the switch arm and push the arm to the standard, a hollow vertical cylinder, a piston movable in the cylinder, and a cable connected with the piston and extending over the periphery of the wheel and secured thereto.

8. In an electrical circuit time switch, the combination of a vertically-supported hollow cylinder with a closure in the bottom thereof, a piston closely fitting in and movable in the cylinder and having a channel extending vertically therethrough, a valve adjustably secured in the piston and extending transversely into the channel, a wheel rotatively supported, a cable connected with the piston and the periphery of the wheel, two supported contacting circuit breaker elements, and a device operated by the wheel to engage one of said elements and move it from contact with the other.

9. In an electrical circuit time switch, the combination of a vertical hollow cylinder with a closed lower portion, a piston movable in close-fitting arrangement in the cylinder and having a channel extending vertically therethrough, a wheel rotatively supported, a cable connected with the piston and the periphery of the wheel, a lever pivotally supported, a brake band extending about the wheel and connected to the lever adjacent to its supporting pivot, two supported contacting circuit breaker elements arranged in proximity to the wheel, and a device operated by the wheel to engage and move one of said elements from contact with the other.

10. In an electrical circuit time switch, the combination of a vertical hollow cylinder, a piston movable in the cylinder, two supported contacting circuit breaker elements, a wheel rotatively supported and having a device operated thereby to engage and move one of said elements from contact with the other, a cable connected with the piston and the periphery of the wheel, a lever pivotally supported adjacent to the wheel, a brake band extending about the wheel and connected to the lever adjacent to its supporting pivot, a supported switch device, a supported elastic switch arm arranged below the switch device to contact therewith, and a controlling device movably guided to alternately control the lever and the switch arm.

11. In an electrical circuit time switch, the combination of a vertical hollow cylinder,

a piston movable in the cylinder, two supported contacting circuit breaker elements, a supported indicator dial, a shaft rotatively supported and extending through the dial, a knob fixed to the shaft and having a pointer thereon opposite to the dial, a wheel secured to the shaft, a cable connected with the piston and the periphery of the wheel, a device carried by the wheel to engage one of the said elements and move it from contact with the other, a governor adjustable to the wheel, and a locking device to operate on the wheel.

In testimony whereof, I affix my signature in presence of two witnesses.

EDWIN L. EDWARDS.

Witnesses:
E. T. SILVIUS,
R. H. SAMPLE.

E. L. EDWARDS.

ADJUSTABLE X-RAY TUBE HOLDER.

APPLICATION FILED MAR. 20, 1920.

1,423,924.

Patented July 25, 1922.

2 SHEETS—SHEET 1.

Fig. 1.

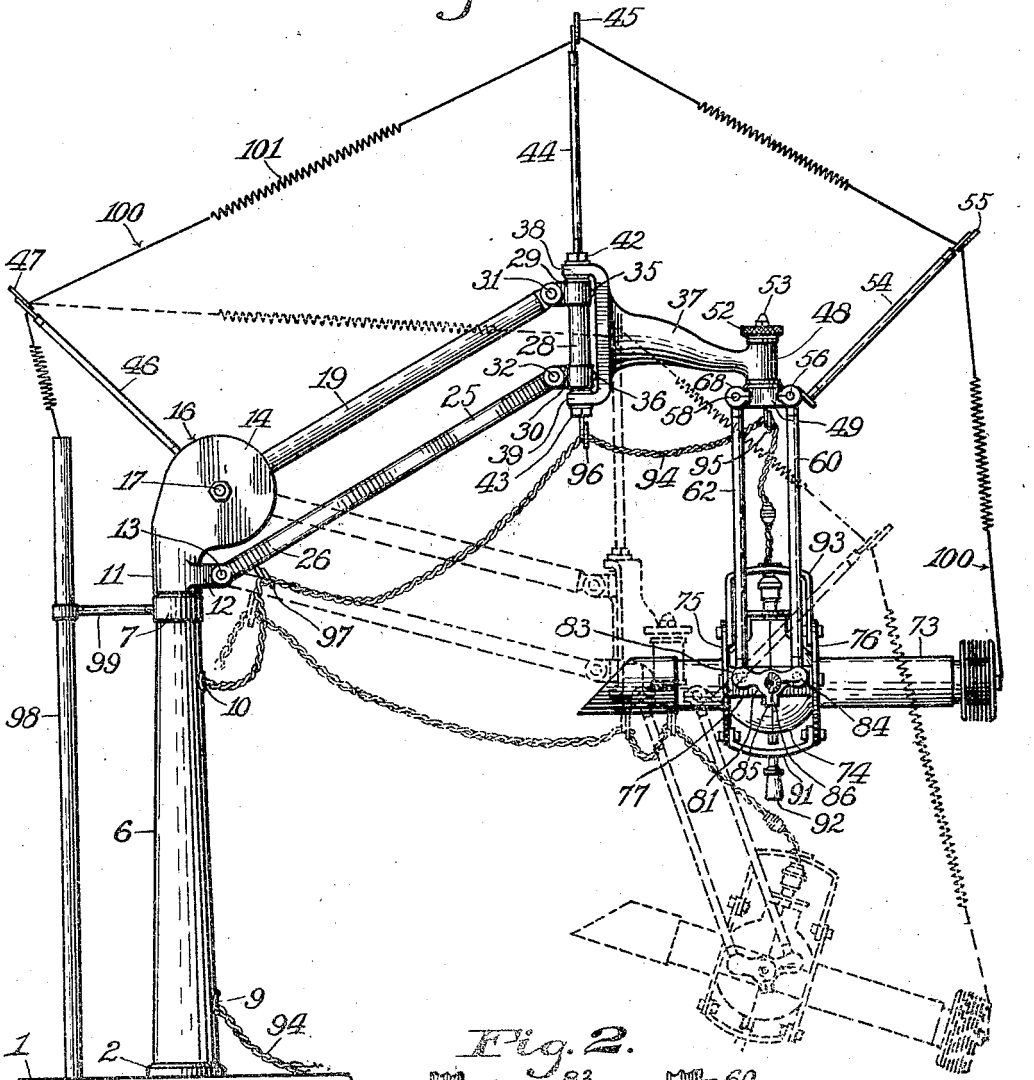
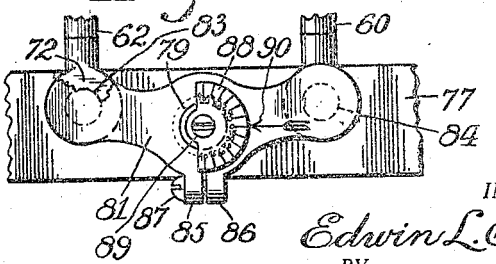


Fig. 2.



WITNESS:

Ed. J. Clark

F. M. Roedis

INVENTOR:

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BY

E. T. Silvius.

ATTORNEY.

E. L. EDWARDS.

ADJUSTABLE X-RAY TUBE HOLDER.

APPLICATION FILED MAR. 20, 1920.

1,423,924.

Patented July 25, 1922.

2 SHEETS—SHEET 2.

Fig. 3.

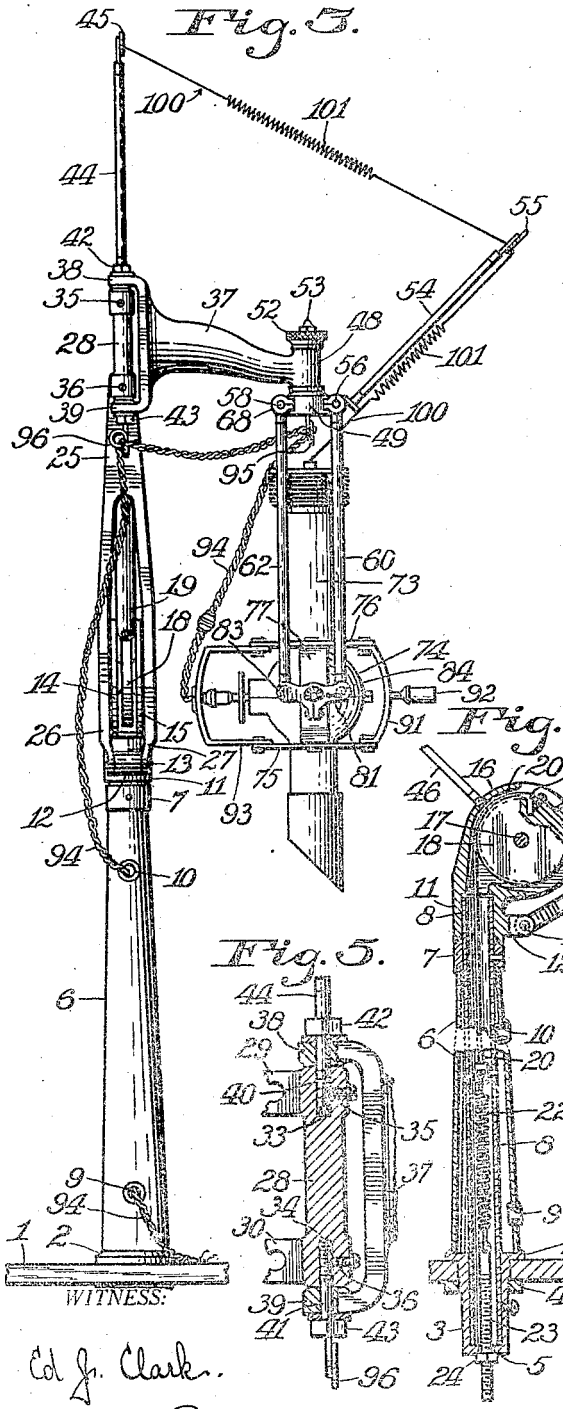


Fig. 4.

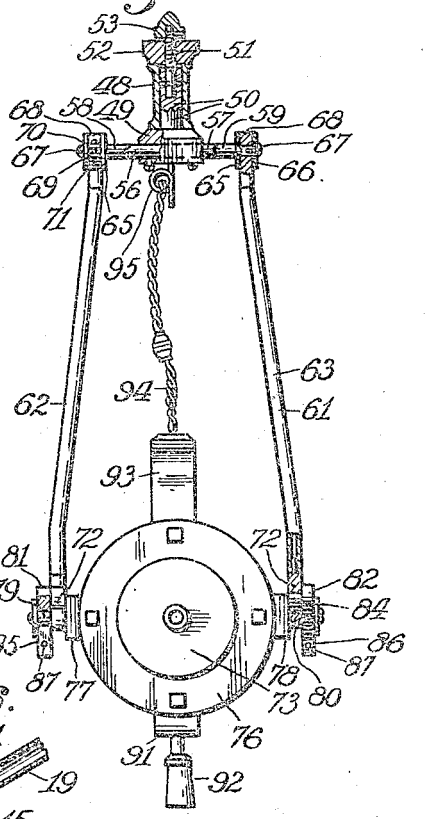


Fig. 6.

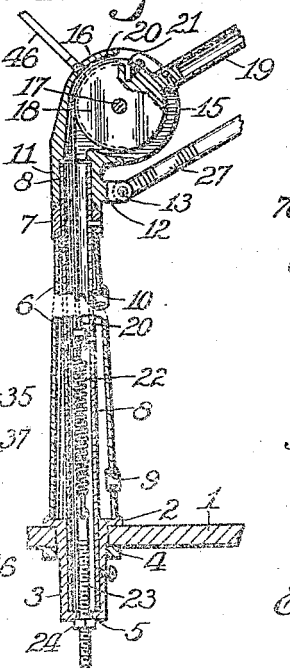


Fig. 5.

Fig. 7.

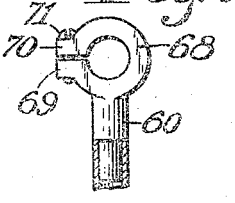
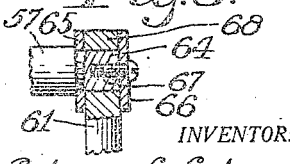


Fig. 8.



WITNESS:

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INVENTOR:

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ATTORNEY.

UNITED STATES PATENT OFFICE.

EDWIN L. EDWARDS, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO EDWARDS X-RAY CORPORATION, OF INDIANAPOLIS, INDIANA, A CORPORATION OF INDIANA.

ADJUSTABLE X-RAY-TUBE HOLDER.

1,423,924. Specification of Letters Patent. Patented July 25, 1922.

Application filed March 20, 1920. Serial No. 367,301.

To all whom it may concern:

Be it known that I, EDWIN L. EDWARDS, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Adjustable X-Ray-Tube Holder, of which the following is a specification, reference being had to the accompanying drawings and to the letters and figures of reference marked thereon.

This invention relates to an apparatus for holding an X-ray tube adjustably so that the tube may be held in different positions near to various portions of an object, the invention having reference more particularly to a tube holder that is designed to enable the X-ray tube to operate as on a crane and to be swung about by the operator, or to be firmly held in adjusted position.

An object of the invention is to provide an X-ray tube holder which shall be so constructed as to enable an operator to quickly adjust the X-ray tube in a simple manner, and in any position required for use; which tube holder shall be of light-weight but firm structure.

Another object is to provide an X-ray tube holder which shall be so constructed as to be adapted to be supported with its base at any desired angle necessary for convenient use, as upon a table or stand top, in inverted arrangement under a ceiling, or on the side of a wall, so as to be agreeable with conditions in any particular operation room.

A further object is to provide an adjustable X-ray tube holder which shall possess the maximum number of advantageous features with the minimum number of simple and reliable parts not liable to be injured in use, which holder shall be adapted to be folded when not in use so as to not occupy space which may be needed for other operations, and which shall be durable and economical in use.

With the above-mentioned and other objects in view, the invention consists in an X-ray tube holder having various novel features of construction enabling the holder to firmly support an X-ray tube in adjusted position and on any one of a great variety of relatively angular and other advantageous positions with respect to a stationary object or subject; and the invention consists also further in the novel parts, and in the different combinations and arrangements of parts, as hereinafter particularly described and further defined in the accompanying claims.

Referring to the drawings, Figure 1 is a side view of the X-ray tube holder as preferably constructed and in one of its convenient arrangements; Fig. 2 is a fragmentary detail of the holder on an enlarged scale; Fig. 3 is an elevation of the holder in folded arrangement; Fig. 4 is a fragmentary sectional elevation showing details of the hanger portion of the tube holder on an enlarged scale; Fig. 5 is a fragmentary sectional detail of associated parts of the holder; Fig. 6 is a vertical section of the column or main member of the holder, partially broken away, in which balancing-appliances are illustrated; Fig. 7 is a fragmentary detail of a hanger rod for the X-ray tube; and, Fig. 8 is a fragmentary sectional detail of the hanger rod and its supporting pivot.

In the different figures of the drawings like characters of reference indicate like parts or features of construction herein referred to in detail.

For the purpose of illustrating the invention it is shown in one of the various different arrangements in which it is adapted to be used, being secured to the top 1 of a cabinet, table or stand which may be variously constructed. The improved holder comprises a column which has a base plate 2 seated upon the top 1 and having a downward extending socket portion 3 on which is a lock nut 4 engaging the under side of said top 1 to firmly secure the base thereto, the socket portion of the base having a bottom 5. A tapering shell 6 has its larger end seated upon the base plate 2 and supports an annular bearing member 7 on its top. A tubular column body part 8 extends into the socket portion 3 and is fixedly secured thereto, and it extends upward through the shell 6 and the bearing member 7, being secured to the bearing member, whereby to secure the shell in place, so as to constitute a substantial and stiff compound column or mast structure, the upper projecting portion of the tubular part 8 constituting a pivot upon the column. Preferably the lower portion of the shell or casing 6 has a guide opening 9 and the upper portion has a guide-opening 10 to receive an electrical circuit cable. An improved column head is provided which

comprises a base portion 11 having a jaw 12 supporting a pivot 13, and two side plates 14 and 15 having a top portion 16 connected thereto and to the base portion, the latter being supported upon the bearing member 7 to rotate on the pivot portion of the column, the side plates 14 and 15 supporting a pivot 17 above the pivot 13. An improved crane arm is provided which comprises a base portion 18 which is mounted on the pivot 17 between the side plates 14 and 15 and is cylindrical or has a cylindrical upper portion, and a main arm or rod portion 19 fixed to the base portion 18. The crane arm is provided with counter-balancing appliances which preferably comprise a ribbon or cable 20, which may be composed of metal or other suitable material, and having a lug 21 secured to the upper portion of the base member 18 and extending over the curved portion of the member and downward into the tubular part 8, in which it is connected to a long coil spring 22 which has an adjusting screw 23 connected thereto that extends through the bottom 5 of the base socket 3, an adjusting nut 24 being arranged on the adjusting screw against said bottom to adjust the tension of the spring. The crane arm has a parallel rod comprising a main member 25 and two shoulder members 26 and 27 that are connected to the pivot 13. An improved coupler head is provided which comprises a main portion 28 having pivot ears 29 and 30 provided respectively with pivots 31 and 32 which are spaced apart equal to the space between the horizontal pivots 13 and 17. The pivot 31 is connected with the main arm member 19 and the pivot 32 is connected to the arm member 25. The upper portion of the main portion 28 of the coupler head has a threaded socket 33 and the lower portion a threaded socket 34, set-screws 35 and 36 being arranged in the walls of the sockets respectively. A crane arm member 37 of improved construction is provided which has pivot ears 38 and 39 that closely embrace the ends of the coupler head and are guided on pivot studs 40 and 41, which are screwed into the sockets 33 and 34 respectively to be engaged by the set-screws when properly adjusted, the pivot studs having heads 42 and 43 whereby to draw the pivot ears 38 and 39 more or less tightly to the pivot head to bind the ears to the head if desired or cause frictional resistance to pivotal movement. Preferably a guide post 44 is supported by the head 42 and has a guide eye or ring 45 on its top. The shoulder members 26 and 27 are properly spaced apart so as to receive the head plates 14 and 15 between them when the crane arm is swung upward. A guide post 46 is supported by the column head or cap head, being preferably secured to the top portion 16, and it is provided with a guide ring 47. The crane arm member 37 is provided with a vertical swivel head 48, and an improved hanger head 49 is provided which has a central journal or stem 50 rotatably arranged in the swivel head. The journal has a screw stud 51 which preferably is made separately and secured in the journal and is provided with an adjusting nut 52 arranged to seat upon the top of the swivel head and bind the hanger head securely to the swivel head, or so as to frictionally retard rotation of the hanger head. The screw stud 51 has a stop head 53 thereon slightly above the adjusting nut so as to permit the latter to be turned slightly and permit the hanger head to freely rotate, the stop head preventing the adjusting nut from accidentally working off of the screw. The hanger head supports a guide post 54 which has a guide ring 55 thereon. The hanger head is provided with two pivots 56 and 57 extending in alinement from opposite sides thereof and also two pivots 58 and 59 extending in alinement from opposite sides thereof, the pivots being horizontally arranged. Two hanger rods 60 and 61 are connected to the pivots 56 and 57 respectively and two similar hanger rods 62 and 63 are connected to the pivot rods 58 and 59 respectively. Preferably each pivot has a relatively small bearing portion 64 on which a collar 65 is arranged, and another collar 66 is arranged at the end of the bearing portion and secured in place by a screw 67 inserted into the bearing portion. The upper end of each hanger rod has a boss 68 which is arranged on the bearing portion of the pivot between the two collars which prevent lateral play of the boss on the bearing portion. The boss is slotted transversely and has lugs 69 and 70 thereon provided with a clamp screw 71 whereby the boss is drawn tightly on the bearing portion of the pivot, and there being four hanger rods the frictional resistance created by their bosses may be made sufficient to prevent swinging of the rods with the weight carried by them but permit the rods to be swung with slight manual effort. The lower end of each hanger rod has a suitable boss 72 thereon adapted to be connected to a pivot. The X-ray tube 73 includes a glass globe 74, and at opposite sides of the globe the tube is provided with frame plates 75 and 76 to which frame bars 77 and 78 are secured, the frame bars being provided with trunnions or pivots 79 and 80 respectively which are rotatively supported in the middle portions of balanc bars 81 and 82. Each balance bar has pivots 83 and 84 adjacent to opposite ends thereof, the pivots on one of the balance bars supporting the bosses on the lower ends of the hanger rods 62 and 60 respectively, the pivots on the remaining one of the balance bars supporting the bosses on the ends of the remaining hanger rods. The balance

bars have each a pair of clamp ears 85 and 86 on the lower portion thereof, being slotted between the ears, and the ears are provided with a clamp screw 87 whereby the balance bar may be frictionally held to its trunnion with more or less force as may be desired. A graduated indicator plate 88 is secured by a screw 89 to one of the trunnions and extends at the outer side of the balance bar, the latter having an indicating mark 90 thereon which points to the zero mark when the X-ray tube is horizontal, said indicator plate having degrees marked thereon on each side of the zero mark so as to indicate the inclination of an X-ray tube when it is adjusted to various angles. The X-ray tube frame comprises also a cross bar 91 secured to the plates 75 and 76 and having a handle 92 thereon for controlling the position of the X-ray tube. Also an arch 93 is secured to the frame plates and guides an electrical circuit cable 94 which extends loosely through a guide ring 95 connected to the hanger head 49. The cable preferably extends through a guide ring 96 connected to the head 43 and through a guide ring 97 with which the crane arm is provided, and thence through the guide opening 10 into and through the space between the outer and inner parts 6 and 8 of the column and out through the guide opening 9 to a source of electricity.

Preferably a tubular guide 98 is arranged to extend through the supporting member 1 and has a brace 99 connected thereto that is secured to the bearing member 7 of the column, and a circuit wire 100 extends through the guide and also through the guide rings 47, 45 and 55, and thence into the X-ray tube, the circuit wire preferably having coiled portions 101 so as to be longitudinally elastic to permit swinging of the X-ray tube without fracturing the circuit wire.

In practical use the subject is conveniently placed and the X-ray tube will be put into action in the customary manner and with the improved holder may be shifted about and adjusted universally as may be required or desired for convenience, the tube being moved at will either towards or from the subject acted upon, in some cases the crane arm being swung upward or downward, the arm member 37 swung about on its pivot, or the hanger head 49 may be turned in the crane arm, or the hanger arms may be variously adjusted from the vertical, while the X-ray tube may be tilted on its trunnions, the circuit wires permitting all the various adjustments without being strained or broken. When the X-ray tube is not in use the holder may be folded up and the X-ray tube turned up vertically so as to be in compact arrangement, as shown in Fig. 3. In Fig. 1 the holder is shown by broken lines in an adjusted position to lower and tilt the X-ray tube.

Having thus described the invention, what is claimed as new is—

1. An X-ray tube holder including an arm, a hanger head connected to the arm and having four pivots on one and the same horizontal plane thereon, four hanger rods connected to and extending downward from the pivots respectively, and an X-ray tube frame provided with four pivots on one and the same horizontal plane and supported by the lower portion of the hanger rods respectively.

2. An X-ray tube holder including an arm, a hanger head swiveled to the arm and having four pivots on one and the same horizontal plane thereon, means for frictionally binding and preventing movement of the hanger head on the arm, four hanger rods connected to and extending downward from the pivots respectively, and an X-ray tube frame having four pivots on one and the same horizontal plane and supported by the lower portions of the hanger rods respectively.

3. An X-ray tube holder including an adjustable arm, a hanger head connected to the arm and having four pivots arranged on one and the same horizontal plane and rigid thereon, four hanger rods connected to and extending downward from the pivots respectively and provided each with a friction binder to retard pivotal movement of the rod on the pivot, and an X-ray tube frame provided with four pivots on one and the same horizontal plane and supported by the hanger rods respectively.

4. An X-ray tube holder including an adjustable arm, a hanger head connected to the arm and having four pivots arranged on one and the same horizontal plane thereon, four hanger rods connected to and extending downward from the pivots, means for binding and preventing free pivotal movement of the hanger rods on the pivots, a balance bar supported by the lower portions of two of the hanger rods, a companion balance bar supported by the lower portions of the remaining two hanger rods, and an X-ray tube frame arranged between and pivotally supported by the two balance bars.

5. An X-ray tube holder including a column, a column head pivoted to the column and having two horizontal pivots, two parallel rods connected to the pivots respectively, a coupler head having pivotal connection with the parallel rods, an arm having a jaw ear pivoted to the coupler head and provided with a swivel-head, a hanger head swiveled to the swivel-head and having four pivots thereon, four hanger rods connected to the four pivots respectively, and an X-ray tube frame having four pivots

supported by the hanger rods respectively.

6. An X-ray tube holder including an adjustable arm having a hanger head connected thereto, an X-ray tube frame provided with two pivots, two balance bars connected between their ends to the pivots respectively to pivotally support and balance the tube frame and provided with friction binders to retard pivotal movement of the frame, two hanger rods pivotally connected to the hanger head and also to the end portions respectively of one of the balance bars, and two hanger rods pivotally connected also to the hanger head and to the end portions respectively of the remaining one of the balance bars.

7. An X-ray tube holder including a hollow column having a column head pivoted thereon, the column head having two horizontal pivots, two parallel rods connected to the pivots respectively and having a coupler head pivotally connected thereto, an arm member having ears pivotally connected to the coupler head, the arm member being provided with a swivel-head, a hanger head swiveled to the swivel head, a plurality of hanger rods pivoted to the hanger head, an X-ray tube frame having pivots supported by the hanger rods, and counter-balancing appliances arranged in the hollow column and connected with one of the two parallel rods.

8. An X-ray tube holder including a pivoted arm having a swivel-head, a hanger head connected to the swivel-head and having four pivots thereon, four hanger rods connected to the pivots respectively, a balance bar having pivotal connection at its ends with two of the hanger rods, a balance bar having pivotal connection at its ends with the remaining hanger rods, an X-ray tube frame having two trunnions connected to the middle portion of the balance bars respectively, one of the trunnions extending through the balance bar, a graduated indicator plate secured to the end of the extended trunnion, an indicating mark arranged on the balance bar adjacent to said plate, and a handle on the X-ray tube frame.

9. In an X-ray tube holder, the combination with an X-ray tube, of a frame to support the X-ray tube and having two trunnions thereon, two balance bars connected at their middle portions to the trunnions respectively, two hanger rods pivotally connected to one of the balance bars adjacent to the opposite ends respectively thereof, two hanger rods pivotally connected to the remaining one of the balance bars adjacent to the opposite ends respectively thereof, and a hanger head having four pivots supporting the hanger rods respectively, with a column, and an arm adjustably mounted on the column and supporting the hanger head.

10. In an X-ray tube holder, a column comprising a base plate having a socket wall extending downward therefrom, a tapered shell seated upon the base plate, an annular bearing member seated upon the shell, a tubular shaft secured to the socket wall and extending through and secured to the bearing member, and a column head rotatively connected to the projecting portion of the tubular shaft and supported upon the bearing member, said head having two horizontal pivots, in combination with two arm members connected to the pivots respectively, a coupler head pivotally connected to the arm members, and an arm member having pivotal connection with the coupler head.

11. In an X-ray tube holder, the combination with a crane arm, and an X-ray tube, of a hanger head supported on the crane arm and provided with four pivots, four hanger rods connected to the pivots respectively and having each a frictional grip on the pivot, a balance bar pivotally connected at opposite ends thereof respectively to two of the hanger rods, a balance bar pivotally connected at opposite ends thereof respectively to the remaining two hanger rods, and a frame supporting the X-ray tube and having two trunnions thereon pivotally supported in the middle portions of the balance bars respectively, the trunnions being frictionally gripped by the balance bars.

12. In an X-ray tube holder, the combination with a column, two parallel arm members pivotally supported one above the other on the column, and an X-ray tube, of a coupler head having pivotal connection with the two parallel arm members, a single arm member having two ears on one end and a swivel head on the opposite end thereof, the ears of the single arm member having contact with the top and the bottom respectively of the coupler head, two pivotal screws connected with the top and the bottom respectively of the coupler head and pivotally connecting the adjacent ears to the head, the pivotal screws having heads to bind the ears to the coupler head, a hanger head connected to the swivel head, hanger rods pivoted to the hanger head, and a frame supported by the hanger rods and supporting the X-ray tube.

13. In an X-ray tube holder, the combination with a column having a bearing member on the top thereof and also a pivot projecting above the bearing member, of a column head guided on the pivot and supported upon the bearing member, the lower portion of the column head having a pivot ear thereon, the upper portion of the column head having two upright head plates thereon and above the pivot ear, a pivot connected horizontally to the pivot ear, a pivot connected horizontally to the head plates, a parallel arm member connected to the

pivot on the pivot ear, a main arm member having a cylindrical base member arranged between the head plates and connected to the pivot thereon, a coupler head having horizontal pivots connected to the said arm members and having vertical pivots thereon, a single arm member having ears connected to the vertical pivots, to support the X-ray tube, and a counterbalance connected with the cylindrical base member of the main arm member.

14. In an X-ray tube holder, the combination of a base plate having a socket wall extending downward therefrom and a bottom fixed to the wall, a shell seated upon the base plate, a tubular shaft supported upon said bottom and secured to said socket wall, the shaft extending upward beyond said shell, an annular bearing member fixed on the shaft and in contact with the top of said shell, a column head rotatively connected with the upper portion of the shaft and supported upon the bearing member, said head having a pivot on one side thereof and also two head plates above the pivot, a pivot supported by said head plates, a parallel arm having two shoulder members connected with the first described pivot, a cylindrical arm base between said head plates and connected to the pivots supported thereby, a main arm fixed on said arm base, a cable secured to the periphery of said arm base and extending into said shaft, a coil spring connected to said cable, an adjusting screw connected to said spring and extending through said socket wall bottom, a nut on said screw beneath said bottom, a coupler head pivotally connected to said arms, and a single arm member pivotally connected with the coupler head.

15. In an X-ray tube holder, the combination of a hollow column, a column head pivoted to the column, a post supported upon the column head and having a guide eye thereon, two parallel arm members pivoted to the column head, a coupler head pivotally connected to the arm members and having a post thereon provided with a guide eye, an arm member pivotally connected to the coupler head and having a swivel head thereon, a hanger head connected to the swivel head and having a post thereon provided with a guide eye, a guide ring supported on the lower portion of the hanger head, a guide ring supported on the lower portion of the coupler head, a guide ring supported on the under side of one of the parallel arm members, hanger rods supported by the hanger head, an X-ray tube frame supported by the hanger rods, an X-ray tube mounted in the X-ray tube frame, an electrical circuit wire extending through all the guide eyes to the X-ray tube, and an electrical circuit cable extending into the lower portion and out of the upper portion of the hollow column and thence through all the guide rings to the X-ray tube.

In testimony whereof, I affix my signature in presence of two witnesses.

EDWIN L. EDWARDS.

Witnesses:
E. T. SILVIUS,
F. M. ROEDER.